



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY WASHINGTON, D.C. 20460

Application for Critical Use Exemption of Methyl Bromide for Use in 2005 in the United States

WHY IS THIS INFORMATION NEEDED?

Under the Clean Air Act and the international treaty to protect the ozone layer (the Montreal Protocol on Substances that Deplete the Ozone Layer), the production and import of methyl bromide will be phased out in the United States on January 1, 2005. This application seeks information to support a U.S. request to produce and import methyl bromide for certain critical uses and circumstances beyond this 2005 phaseout date.

The information in this application will be used to review whether your use of methyl bromide is "critical" because no technically and economically feasible alternatives are available. In order to estimate the loss as a result of not having methyl bromide available, EPA needs to compare data (yields, crop/commodity prices, revenues and costs) for your use of methyl bromide with uses of alternative pest control regimens.

If you submit a well documented application with sound reasons why alternatives are not technically and economically feasible, the U.S. government can be a better advocate for your exemption request internationally.

Click on the Instructions tab located at the bottom of the screen for additional information.

Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information. Public reporting burden for this collection of information is estimated to average 324 hours per response and assumes a large portion of applications will be submitted by consortia on behalf of many individual users of methyl bromide. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a current OMB control number.

OMB Control # 2060-0482



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460**

INSTRUCTIONS

The information provided by you in this application will be used to evaluate the requested methyl bromide use. The U.S. and other countries that are parties to the Montreal Protocol On Substances That Deplete The Ozone Layer decided that: "a use of methyl bromide should qualify as "critical" only if the nominating Party determines that:

- (i) The specific use is critical because the lack of availability of methyl bromide for that use would result in a significant market disruption; and
- (ii) There are no technically and economically feasible alternatives available to the user that are acceptable from the standpoint of environment and health and are suitable to the crops and circumstances of the nomination ..."

WHO APPLIES?	<p>If you anticipate that you will need methyl bromide in 2005 because you believe there are no technically and economically feasible alternatives, then you should apply for the critical use exemption. This application may be submitted either by a consortium representing multiple users or by individual users. We encourage users with similar circumstances of use to submit a single application (for example, any number of pre-plant users with similar soil, pest, and climactic conditions can submit a single application.)</p> <p>If a consortium is applying for multiple methyl bromide users, the economic data should be for a representative or typical user within the consortium unless otherwise noted. If economic or technical factors (such as size of the farm) affecting the ability of this "representative user" to use alternatives are significantly different than other users in the consortium, more than one application should be submitted to reflect these differences.</p> <p>Please contact your local, state, regional or national commodity association and/or state representative agency to find out if they plan on submitting an application on behalf of your commodity group.</p>
STATE CONTACTS	States that have agreed to participate in the exemption process are listed on EPA's website at www.epa.gov/ozone/mbr/cueqa.html
HOW DO I APPLY?	You may either complete an electronic (Microsoft Excel) or a printed version of the application. Please fill out each form or worksheet in the application as completely as possible. If you are completing the printed version and need extra space you may attach additional sheets as needed. Additional information may be available from your local state department of agriculture or at the sites listed below or by calling 1-800-296-1996.
SECTIONS OF WORKBOOK	<p>Each worksheet number corresponds to the tab number in the electronic version of the application. Instructions specific to each worksheet are provided at the top of each sheet. A header row is included on each worksheet to include an application ID number that EPA will assign.</p> <p>Instructions</p> <p>Worksheet 1. Contact and Methyl Bromide Request Information</p> <p>Worksheet 2. Methyl Bromide - Historical Data</p> <p>2-A. Methyl Bromide Use 1997-2000</p> <p>2-B. Methyl Bromide - Crop/Commodity Yield and Revenue 1997-2000</p> <p>2-C. Methyl Bromide - Crop/Commodity Yield and Revenue 2001</p> <p>2-D. Methyl Bromide Use and Costs for 2001</p> <p>2-E. Methyl Bromide - Other Operating Costs for 2001</p> <p>2-F. Methyl Bromide - Fixed and Overhead Costs</p> <p>Worksheet 3. Alternatives - Feasibility of Alternatives to Methyl Bromide</p> <p>3-A. Alternatives - Technical Feasibility</p> <p>Research Summary Worksheet</p> <p>Example Research Sum (Summary) Worksheet</p> <p>3-B. Alternatives - Pest Control Regimen Costs</p> <p>3-C. Alternatives - Crop/Commodity Yield and Revenue</p> <p>3-D. Alternatives - Other Operating Costs</p> <p>Worksheet 4. Alternatives - Research Plans</p> <p>Worksheet 5. Additional Information</p> <p>Worksheet 6. Application Summary</p> <p>Fumigation Cycle</p> <p>Climate Zone Map</p>



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460**

IS MY INFORMATION CONFIDENTIAL?	<p>The applicant may assert a business confidentiality claim covering part or all of the information in the application by placing on (or attaching to) the information, at the time it is submitted to EPA, a cover sheet, stamped or typed legend, or other suitable form of notice employing language such as trade secret, proprietary, or company confidential. Allegedly confidential portions of otherwise non-confidential documents should be clearly identified by the applicant, and may be submitted separately to facilitate identification and handling by EPA. If the applicant desires confidential treatment only until a certain date or until the occurrence of a certain event, the notice should so state. Information covered by a claim of confidentiality will be disclosed by EPA only to the extent, and by means of the procedures set forth under 40 CFR Part 2 Subpart B; 41 FR 36902, 43 FR 400000. 50 FR 51661. If no claim of confidentiality accompanies the information when it is received by EPA, it may be made available to the public by EPA without further notice to the applicant. Applicants submitting their application via e-mail assume responsibility for the confidentiality of the electronic me</p>
WHEN IS THE INFORMATION NEEDED?	<p>This application must be postmarked to the EPA address below no later than 120 days after the Notice was published in the <u>Federal Register</u> requesting critical use exemption applications.</p>
WHERE DO I SUBMIT THE APPLICATION?	<p>Electronic Address for applications: methyl.bromide@epa.gov</p> <p>(When submitting an application electronically, you should also print a hard copy, sign the copy, and submit it by mail)</p> <p>Mailing Address for applications being submitted by <u>mail</u> directly to the EPA: US Environmental Protection Agency Methyl Bromide Critical Use Exemption Global Programs Division, Mail Code 6205J 1200 Pennsylvania Ave, NW Washington, DC 20460-0001</p> <p>Address for applications being sent by <u>courier</u> or <u>non-U.S. Postal overnight express</u> delivery to EPA: US Environmental Protection Agency Methyl Bromide Critical Use Exemption Global Programs Division 501 3rd St. NW Washington, DC 20001 phone: (202) 564-9410</p>
HOW CAN I RECEIVE ADDITIONAL INFORMATION?	<p>If you have general questions about this application call:</p> <p>Stratospheric Ozone Hotline 1-800-296-1996</p>



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460**

<p>EXCEL USER TIPS</p>	<p>Inserting a blank worksheet:</p> <ol style="list-style-type: none"> 1 To add additional blank worksheets in the Excel file, go to the menu line at the top of the worksheet and select "Insert" then "worksheet" 2 A tab with the name "Sheet 1" will appear at the bottom of the worksheet and will be highlighted in white. Take the cursor and double click the "new tab" 3 By double clicking in the tab you can now rename the worksheet to the appropriate number letter designation (e.g., 3-A(1), 3-A(1)(a), etc.) 4 To move a newly inserted worksheet, simply drag the worksheet with your mouse to the desired location. 5 Once you add a new worksheet, Excel will automatically name each subsequently added worksheet as Sheet 2, Sheet 3, Sheet 4, etc... Follow the instructions above to rename the new blank worksheets as appropriate.
	<p>Copying and pasting an entire worksheet's contents into a blank worksheet:</p> <ol style="list-style-type: none"> 1 Select the worksheet to be copied by clicking on the worksheet tab at the bottom of the screen. The tab will turn white in color when it has been selected. 2 Select the top left corner of the worksheet (this is the space to the left of the column A and above the row 1. You will know that the entire worksheet has been selected because the row and column marks as well as the worksheet itself will change to a different color. 3 Go to the menu line at the top of the worksheet and select "Edit" then "Copy". 4 Go to the blank worksheet where you want the copied information to be pasted. 5 Again, select the top left corner of the worksheet (left of column A and above row 1) to select the entire worksheet. 6 Go to the menu line at the top of the worksheet and select "Edit" then "Paste" 7 Change the title row of the newly pasted worksheet from the old worksheet number to be consistent with the worksheet tab. <p>Note: This is the only way you can copy a worksheet and not lose portions of the text instructions.</p>
	<p>Viewing worksheets</p> <p>Worksheets are best viewed in "Page Break Preview." To select the view of the worksheet, go to the menu bar and select "View" and then "Page Break Preview." Page break preview shows only the printable area of the worksheet, with the blue lines that surround the screen indicating the edges of each page.</p> <p>To increase or decrease the size of the page that is viewable on the screen, go to the menu bar and select "View" and then "Zoom".</p>
	<p>Navigating between worksheets</p> <p>The set of four arrows on the bottom left of the screen will help you navigate between worksheets. This is necessary to access the remaining worksheet tabs in the workbook that are not viewable. The two arrows with vertical lines to either the left or right will take you to the first worksheet and to the last worksheet respectively in the workbook. The inner two arrows allow you move the worksheet tabs to the right or to the left incrementally.</p> <p>The two arrows on the bottom right of the screen allow you to move the worksheet that you are viewing to the right or to the left. This is useful if the viewable area of on the screen is smaller than the entire page that is in the worksheet.</p>
	<p>Printing worksheets</p> <p>If you would like to print all worksheets that are contained in this workbook, go to the menu bar at the top of the screen and select "File" and then "Print." Then in the section of the menu that appears called "Print what," select "Entire Workbook."</p>

Worksheet 1. Contact and Methyl Bromide Request Information

The following information will be used to determine the amount of methyl bromide requested and the contact person for this request. It is important that we know whom to contact in case we need additional information during the review of the application.

1. Location

(Enter the state, region, or county. Provide more detail about the location if relevant to the feasibility of alternatives to methyl bromide.)

The Western States, specifically the public nurseries in the states of California, Idaho, Kansas, Nebraska, Oregon, Utah, Washington

2. Crop/commodity

(Include all crops/commodities that benefit from the application of methyl bromide in a fumigation cycle. A fumigation cycle is the period of time between methyl bromide fumigations.)

Nursery grown conifer and hardwood (deciduous) bareroot tree seedlings and transplants used for reforestation. Conifer species include *Pseudotsuga menziesii*, *Larix occidentalis*, *Pinus* spp., *Abies* spp., *Picea* spp. Hardwood species include *Quercus*, *Populus*, *Acer*. In addition to tree seedlings, a variety of shrub, grass, and forb species are grown. The conifer and hardwood species are used to reestablish timber species in logged areas. These species, along with the shrub, forb, and grass species, are also used in ecosystem restoration following catastrophic events, such as fire, floods, etc. The latter are most commonly planted for wildlife, fisheries, aesthetic, and ecosystem restoration objectives.

3. Climate

(Individual users should enter their climate zone designation by reviewing the U.S. climate zone map. If a consortium is submitting this application, please indicate the estimated percentage of consortium users in each climate zone. This map is located at the end of this workbook or it can be reviewed online at <http://www.usna.usda.gov/Hardzone/ushzmap.html>).

Zone 4 - 13% production; Zone 6 - 2% production; Zone 8 - 71% production; Zone 9 - 12% production; Zone 10 - 2% production

4. Soil type Check the box(es) for the soil types and percent organic matter that apply to your area. If a consortium is submitting this application, please indicate the estimated percentage of consortium users in each soil type.

Soil Type:	Light _____	Medium <u>X</u> _____	Heavy _____
Organic Matter:	0 to 2% _____	2 to 5 % <u>100</u> _____	over 5% _____

5. Other geographic factors that may affect crop/commodity yield (e.g., water table).

None

6. Consortium name	Western Forest and Conservation Public Nursery Association	Specialty (check one)
7. Contact name	Lee E. Riley	agronomic <u>X</u>
8. Address	Dorena GRC, 34963 Shoreview Rd Cottage Grove, OR 97424	economic _____
9. Daytime phone	(541) 767-5723	10. FAX (541) 767-5709
11. E-mail	leriley@fs.fed.us	

List an additional contact person if available.

Specialty (check one)

12. Contact name	Tom D. Landis	agronomic <u>X</u>
13. Address	JH Stone Nursery, 2606 Old Stage Rd Central Point, OR 97502	economic _____
14. Daytime phone	(541) 858-6166	15. FAX (541) 858-6110
16. E-mail	tlandis@fs.fed.us	

Worksheet 1. Contact and Methyl Bromide Request Information

For EPA Use Only
ID#

17. How much active ingredient (ai) of methyl bromide are you requesting for 2005? 45000 lbs.

If a consortium is submitting this application, the data for question 17 and 17a. should be the total for the consortium.

In the question below, area is defined as follows for each user: acres for growers, cubic feet for post harvest operations, and square feet for structural applications.

- 17a. How much area will this be applied to? Please list units. 150 Acres units

18. Are you requesting methyl bromide for additional years beyond 2005? Yes X No

- 18a. If yes, please list year and quantity active ingredient (ai) of methyl bromide requested in the table below and explain why you need authorization for multiple years.

Specific sections of seedling production areas are fumigated each year. The request for a Critical Use Exemption is based on this annual application requirement.

If a consortium is submitting this application, the data below should be the total for the consortium.

In the table below, **area is defined** as follows for each user: acres for growers, cubic feet for post harvest operations, and square feet for structural applications.

Year	Quantity ai (lb.) of Methyl Bromide	Area to be Treated	Unit of Area Treated
2006	45000	150	Acres
2007	45000	150	Acres

19. Target Pest(s) or Pest Problem(s):

(Be as specific as possible about the species or classes of pests relevant to the feasibility of alternatives.)

Fumigation targets a broad spectrum of fungal pathogens, invertebrate pests, and weed species.

Fungal Pathogens: The impact of individual fungal species varies between nurseries. The predominate fungal species include *Macrophomina* (particularly in California), *Cylindrocladium* spp., *Fusarium* Spp., *Pythium* spp., *Phytophthora* spp., *Phoma*, *Phomopsis*, *Verticillium* wilt, *Sirococcus*, root gall pathogens

Invertebrate pests: Fumigation has been shown to be critical in the control of nematodes and larval stages of various species of root weevils which have caused significant crop losses in the past.

Weed species: Fumigation provides the most efficient and effective control of a variety of noxious weed species, including senecio, poa, thistle, and most particularly, *Cyperus* spp., for which there is no currently labeled effective nursery product.

The use of methyl bromide is essential for control of such a broad range of pest species.

20. If applying as a consortium for many users of methyl bromide, please define a **representative user**. Define exactly, issues such as size of the operation (acres treated with methyl bromide for growers, cubic feet for post-harvest operations, and square feet for structural applications), whether the representative user owns or rents the land or operation, intensity of methyl bromide use (treat regularly or only when pest reaches a threshold), pest pressure, etc.

Forest tree nurseries(public) in the western United States produce 40 to 60 million bareroot trees (conifer and hardwood) and .6 to .7 million shrub, forb and grass species annually. Conifer seedlings represent 95 of that total.

Conifer crops are grown as 1-year-old, 2-year-old, or transplants depending on the species or target seedling type. Each crop type requires a different schedule of fumigation and cover crop rotation.

Methyl bromide is predominately used in the western states on a selective basis, targeting only areas where alternative chemicals have been proven to be ineffective or damaging to nearby crops.

Nurseries covered by this consortium are predominately owned by Federal and State governmental forestry agencies. Consortium nurseries are distributed throughout the region.

20a. Explain why this user represents the typical user in the consortium.

The "typical user" as defined for this application is based on nursery surveys, the National Nursery directory (www.mgr.net/nurseries/dirfor.html), and interaction with nursery managers. The Western Forest and Conservation Nursery association has been involved in nursery information and technology transfer for many years, and is familiar with "typical" nursery activities throughout the region.

Worksheet 2-A. Methyl Bromide - Use 1997-2000

If a consortium is submitting this application, all data should reflect the **actual** data for the consortium.

Col A: Formulation of Methyl Bromide

Enter the appropriate data in Col B-M for each formulation, if known, and/or the totals and averages for all formulations. If you enter only the total and averages for all formulations in the last row of the table, please describe in the comments section the formulations typically used, or the approximate proportions of the formulations used.

Col B, E, H, K: Actual Area Treated

Enter the total actual area treated. Note: This number should be the total actual area treated by the individual user or total actual area for the entire consortium, for the year indicated.

Col C, F, I, L: Actual Total lbs. ai of Methyl Bromide Applied

Enter the actual total pounds active ingredient (ai) of methyl bromide applied. Note: This number should be the total pounds ai applied by the individual user or the entire consortium, for the year indicated.

Col D, G, J, M: Actual Average lbs. ai Applied per Area

The average application rates in pounds ai of methyl bromide per area are automatically calculated from the previous 2 columns.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F	G	H	I	J	K	L	M
Formulation of Methyl Bromide	Total Actual Area Treated	1997 Actual Total lbs. ai of Methyl Bromide Applied	Average lbs. ai Applied per Area	Total Actual Area Treated	1998 Actual Total lbs. ai of Methyl Bromide Applied	Average lbs. ai Applied per Area	Total Actual Area Treated	1999 Actual Total lbs. ai of Methyl Bromide Applied	Average lbs. ai Applied per Area	Total Actual Area Treated	2000 Actual Total lbs. ai of Methyl Bromide Applied	Average lbs. ai Applied per Area
over 95% methyl bromide												
75% methyl bromide, 25% chloropicrin												
67% methyl bromide, 33% chloropicrin	140	49000	350	180	63000	350	180	63000	350	190	66500	350
50% methyl bromide, 50% chloropicrin												
__% methyl bromide, __% chloropicrin												
__% methyl bromide, __% chloropicrin												
All formulations of methyl bromide	140	49000	350	180	63000	350	180	63000	350	190	66500	350

Comments:

Methyl bromide use 1997-2000
The purpose of the Western Forest and Conservation Nursery Association has historically been information and technology transfer. As such, we have not historically kept records of seedling production and methyl bromide use numbers. We do, however, have seedling production inventories published by the US Forest Service, as well as historical records of methyl bromide application from the area professional applicators. The above historical data is based on that information from Federal and State nurseries.

Worksheet 2. Methyl Bromide - Historical Use of Methyl Bromide

Purpose of Data: To establish a baseline estimate of crop/commodity yields, gross revenues, and costs using methyl bromide.		
Worksheet	Title	Instructions specific to each worksheet are located at the top of each sheet.
2-A	Methyl Bromide Use for 1997 - 2000	This worksheet provides data in actual usage for 1997-2000.
2-B	Methyl Bromide - Crop/Commodity Yield and Gross Revenue for 1997-2000	This worksheet provides crop/commodity yield and gross revenue for 1997 through 2000.
2-C	Methyl Bromide - Crop/Commodity Yield and Gross Revenue for 2001	This data provides historical information on crop/commodity yield and gross revenue for 2001.
2-D	Methyl Bromide Use and Costs for 2001	This worksheet isolates use and cost data for 2001.
2-E	Methyl Bromide - Other Operating Costs for 2001	This data is needed to estimate a baseline for operating costs in order to estimate the impact on operating profit and short-run economic viability as a result of not using methyl bromide.
2-F	Methyl Bromide - Fixed And Overhead Costs for 2001	This data is needed to estimate a baseline for total costs in order to estimate the impact on profitability and long-run economic viability as a result of not using methyl bromide.

If a consortium is submitting this application, the data for this table should reflect the actual averages for the consortium.	
The purpose of this worksheet is to estimate the gross revenue for 1997 - 2000 when using methyl bromide. Post-harvest and structural users may work with EPA to modify this form to accommodate differences in operations when providing gross revenue data.	
Col. A: Year	Be sure to enter the year. Use as many rows as needed for each year for all the crops/commodities in the fumigation cycles from 1997 to 2000. If a fumigation cycle overlaps more than one calendar year, then the year of the fumigation cycle is the year methyl bromide was applied.
Col. B: Crop/Commodity	Enter all crops/commodities that benefit from methyl bromide in each fumigation cycle. (For example, if normally methyl bromide is applied on tomatoes are grown and harvested followed by peppers without an additional treatment of methyl bromide, then both tomatoes and peppers would be part of the same fumigation cycle.) See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle. If someone other than the applicant benefits from the application of methyl bromide in the fumigation cycle and you do not have the quantitative data for the crops grown on the same land, please indicate so in the comments section below.
Col. C: Unit of Crop/Commodity	Enter the unit of measurement for each crop/commodity.
Col. D: Crop/Commodity Yield	Enter the number of units of crop/commodities produced per area.
Col. E: Price	Enter the average prices received by the users for the year and crop/commodity indicated (1997-2000).
Col. F: Revenue	This number is calculated automatically using the values you entered in Cols. D and E. You may override the formula to enter a different revenue. Please explain why the revenue amount is different in the comment section below.
Total Revenue for 1997-2000	Enter the total revenue per year by adding the revenue for all crops for that year.
Average Revenue per Year:	The average revenue per year is calculated automatically using the summary data you enter for each year.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F
Year Methyl Bromide was Applied	Crop/Commodity	Unit of Crop/Commodity (e.g., pounds, bushels)	Crop/Commodity Yield (Units per area)	Price (per unit of crop/commodity)	Revenue (per area)
1997	Conifer seedlings/transplants	1000 trees	258	\$ 275.00	\$70950/ac
1998	Conifer seedlings/transplants	1000 trees	258	\$ 275.00	\$70950/ac
1999	Conifer seedlings/transplants	1000 trees	258	\$ 285.00	\$73530/ac
2000	Conifer seedlings/transplants	1000 trees	258	\$ 295.00	\$76110/ac
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
Comments: The purpose of the Western Forest and Conservation Nursery Association has historically been information and technology transfer. As such, we have not historically kept records of seedling sales. The above data is based on seedling production inventories and average costs of stocktypes. Although the price per unit and units/acre differ for seedlings and transplants, an average cost and average units/acre were affixed to the commodity.				Total Revenue for 1997	\$9.93 million
				Total Revenue for 1998	\$12.77 million
				Total Revenue for 1999	\$13.24 million
				Total Revenue for 2000	\$14.46 million
				Average Revenue Per Year	\$12.6 million

Stocktype	Units/Ac	Price
Seedling	344	\$220
Transplant	172	\$370
Ave	258	\$295

Worksheet 2-C. Methyl Bromide - Crop/Commodity Yield and Gross Revenue 2001

If a consortium is submitting this application, the data for this table should reflect the **representative user** for the consortium.

The purpose of this worksheet is to estimate the gross revenue for 2001 when using methyl bromide. Post-harvest users may modify this form to accommodate differences when providing gross revenue data. If 2001 was not a typical year for the individual or for the representative user of a consortium, the applicant may provide additional data for a different year. However, all applicants must complete this worksheet for the year 2001 regardless. Please explain in the comment section at the bottom of the worksheet why 2001 is not considered a typical year, if that is the case.

Col. A: Crop/Commodity	Enter all crops/commodities that benefit from methyl bromide in the fumigation cycle (interval between fumigations) beginning with the treatment of methyl bromide in 2001. If multiple crops are grown during the interval between fumigations (e.g. tomatoes followed by peppers in a single growing season, or strawberries followed by lettuce over 2 or 3 years) include all of the crops during the entire interval. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle. If someone other than the applicant benefits from the application of methyl bromide in the fumigation cycle and you do not have the quantitative data for the crops grown on the same land, please indicate so in the comments section below.
Col. B: Price Factors:	Enter factors that determine prices (e.g., grade, time, market). If you received different prices for your crop/commodity as a result of quality, grade, market (e.g. fresh or processing), timing of harvest, etc., you may itemize by using more than one row. Itemize or aggregate these factors to the extent appropriate in making the case that the use of methyl bromide affects these price factors.
Col. C: Unit of Crop/Commodity	Enter the unit of measurement for each crop/commodity.
Col. D: Crop/Commodity Yield	Enter the number of units of crop/commodity produced per area for that price factor.
Col. E: Price	Enter average 2001 prices received by the users for that crop/commodity and price factor.
Col. F: Revenue	Revenue is automatically calculated using the data you entered for yield and price. If revenue is not equal to yield times price, you may override the formula and enter a different revenue amount. Please explain why this revenue amount is different in the comment section below.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F
Crop/Commodity	Price Factors (grade, time, market)	Unit of Crop/Commodity (e.g., pounds, bushels)	Crop/Commodity Yield (Units per area)	Price (per unit of crop/commodity)	Revenue (per area)
Conifer seedlings	Species/age/size	1000 trees	344	\$ 220.00	\$ 75,680.00
Conifer transplants	Species/size	1000 trees	172	\$ 370.00	\$ 63,640.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
				Total Revenue	\$2.41 million

Comments:

Total revenue is calculated for an "average" nursery

Table 2C. Calculation of gross revenue for a "representative user" nursery in 2001

Crop	Production (in millions)	Acres	Value/Ac	Revenue
Conifer seedlings	2.8	8	\$75,680	\$.605 million
Conifer transplants	5	28.5	\$63,640	\$1.81 million

Worksheet 2-D. Methyl Bromide - Use and Costs for 2001

If a consortium is submitting this application, the data in Cols. B, C, D, and E should reflect the *representative user* in the consortium. The data in Col. F should reflect the **actual** area treated by all users in the consortium.

If the methyl bromide is custom applied then put the cost per area in Column G and fill in the average lb ai of methyl bromide applied per area (Col B) and the Total Actual Area Treated (Col F).

If 2001 was not a typical year for the individual or for the representative user of a consortium, the applicant may provide additional data for a different year. However, all applicants must complete this worksheet for the year 2001 regardless. If you provide an additional year's data, please explain in the comment section at the bottom of the worksheet why 2001 is not considered a typical year.

Col. A: Formulation of Methyl Bromide Enter the appropriate data in Col B-G for each formulation, if known, and/or the totals and averages for all formulations of methyl bromide. If you just enter data in the bottom row in the table (All formulations of methyl bromide), please describe in the comments, the relative usage of the various formulations, to the extent known.

Col B: Average lbs. active ingredient (ai) of Methyl Bromide Applied per Area Enter the average pounds active ingredient (ai) of methyl bromide applied per area.

Cols. C, D, E, G: Prices and Costs Enter the average price per pound active ingredient (ai) of methyl bromide in Col. C and the average cost of applying methyl bromide per area treated in Col. D. In Col. E, enter the average other costs per area associated with applying methyl bromide (e.g., tarps). Column G will be calculated automatically using the values you entered in columns B-E. If methyl bromide is custom applied, enter the cost per area in Col. G and fill in Cols. B and F.

Col. F: Actual Area Treated Enter the **actual** area treated. Note: This number should be the total area treated by all users in the consortium.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F	G
Formulation of Methyl Bromide	Lb. ai of Methyl Bromide Applied per Area (2001 Average)	Price per lb. ai of Methyl Bromide (2001 Average)	Cost of Applying Pesticide per Area (2001 Average)	Other MBr Costs (e.g. tarps, etc.) per Area (2001 Average)	Total Actual Area Treated in the Consortium	Cost per Area
over 95% methyl bromide						\$ 0.00
75% methyl bromide, 25% chloropicrin						\$ 0.00
67% methyl bromide, 33% chloropicrin	300 lbs./acre	\$ 2.90	\$ 300.00	\$ 500.00	150	\$ 1,670.00
50% methyl bromide, 50% chloropicrin						\$ 0.00
___% methyl bromide, ___% chloropicrin						\$ 0.00
___% methyl bromide, ___% chloropicrin						\$ 0.00
						\$ 0.00
All formulations of methyl bromide	300 lbs./acre	\$ 2.90	\$ 300.00	\$ 500.00	150	\$ 1,670.00

Comments:

Worksheet 2-F. Methyl Bromide Fixed and Overhead Costs in 2001

If a consortium is submitting this application, the data for this table should reflect a representative user .			
Enter all fixed and overhead costs incurred during the fumigation cycle (interval between fumigations) beginning in 2001. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle.			
Col A: Cost Item	Identify in Col. A the cost items. These items should include, but are not limited to: (1) land rent, (2) interest, (3) depreciation, (4) management, and (5) overhead such as office and administration.)		
Col B: Description	Please describe the cost in more detail.		
Col C: Allocation Method	Please describe how you estimated the portion of total fixed cost of the farm or entity that applies to this crop/commodity.		
Col D: Cost per Area	Enter the cost per area of methyl bromide treated.		
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.			
A	B	C	D
Cost Item	Description	Allocation Method	Cost per Area
Labor and Labor Related	Managerial and Administrative salaries and benefits		\$1,448.27
Postage	FedEx, UPS, and regular mail charges		
Communications	Telephones, Cellular Phones		\$38.56
Data Processing			
Computer Hardware	Computers, printers, etc.		
Rentals-Tangible Properties	Machine Rentals		
Rentals-Real Property	Land Rental		\$466.67
Vehicle Lease Expenses	Auto Lease and Heavy Equipment		\$260.53
Dues and Assessments	Trade Association Dues and Contributions		
Publications	Trade Magazine Subscriptions		
Meetings			
Taxes	Sales and Property Taxes		
Depreciation	Capitalized Interest and Plant Depreciation		\$1,356.00
Legal Settlements	Company Legal Bill		\$197.51
Supplies and Equipment	Managerial and Administrative Supplies		\$114.94
Other Income/Expenses			
Utilities	Water and Electricity		\$191.57
Allocations and Transfers	Corporate and Division Overhead		\$957.85
		Total	\$5,031.90
Comments:			

Worksheet 2-E. Methyl Bromide - Other Operating Costs for 2001

Do not include methyl bromide costs.					
If a consortium is submitting this application, the data for this table should reflect a representative user .					
Enter all operating costs except methyl bromide costs incurred during the fumigation cycle (interval between fumigations) beginning in 2001. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle. Enter these costs in Col B for custom operations, or in Col C and D for operations done by user.					
Submit crop budgets for each crop, if available. You may submit crop budgets electronically or in hard copy. If your costs are significantly different than the crop budgets, please explain in the comments.					
Col A: Operation	Identify in Col A the operations (except methyl bromide) to which the costs apply. For growers, these operations should include but are not limited to (1) prepare soil, (2) fertilize, (3) irrigate, (4) plant, (5) harvest, (6) other pest controls, etc. You must include all other operating costs.				
Col B: Custom Operation Cost	If you incur custom operation costs, enter those costs in Col. B.				
Col C: Material Cost per Area	If you do not incur custom operation costs, enter the material cost per area.				
Col D: Labor Cost per Area	If you do not incur custom operation costs, enter the labor cost per area.				
Col E: Total Cost per Area	The total cost per area is calculated automatically from the values you enter in Cols. C and D.				
Col F: Typical Equipment Used	Identify the typical equipment used for operations done by user. Please be specific, such as tractor horsepower. No cost data is required in this column.				
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.					
A	B	C	D	E	F
Operation	Custom Operation Cost per Area	Operation Done by User			
		Material Cost per Area	Labor Cost per Area	Total Cost per Area	Typical Equipment Used
Soil Preparation		\$ 478.00	\$ 387.00	\$ 865.00	
Sowing		\$335.00	\$ 162.00	\$ 497.00	
Maintenance		\$255.00	\$425.00	\$ 680.00	
Fertilization, Pest Control, pruning, etc.					
Harvest and Storage		\$762.00	\$ 725.00	\$ 1,487.00	
Total Custom per Area			User Total per area	\$3,529.00	
1)					
2)					
3) Note on typical equipment used: <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> Soil Preparation: Sowing: Maintenance Harvest </div> <div style="width: 50%;"> Typical farm tractor and implements Highly specialized machine sowers are used to sow genetically improved seed. Power supplied by farm tractor. Standard tractor drawn boom sprayers. Implements for fertilization, top and root pruning are specially designed for forest tree nurseries. Highly mechanized harvesting operation using specially designed seedling lifters. Seedlings placed in cold storage until shipped to planting site. </div> </div>					

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous page) is or is not effective for your conditions. This worksheet contains 9 questions. You must complete one copy of worksheet 3-A for each research study you use to evaluate a single methyl bromide alternative. Use additional pages as need.

For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed. Please number the worksheets as follows. For the same alternative, first research study, label the worksheet 3-A(1)(a). For the same alternative, second research study, label the worksheet 3-A(1)(b). For the first alternative, third research study, label the worksheet 3-A(1)(c). For the second alternative, first research study, label the worksheet 3-(A)(2)(a). For the second alternative, second research study, label the worksheet 3-(A)(2)(b).

When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions 1, 5, and 8.

Summarize each of the research studies you cite in the Research Summary Worksheet.

If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more relevant research reports. The narrative review must reply to Section I and questions 1 through 8 in Section II. A Research Summary Worksheet of relevant treatments should be provided for each study reviewed.

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could be used successfully instead of methyl bromide by crop and circumstance (geographic area.) The Agency has developed a list of possible alternative pest control regimens for various crops, which can be found at <http://www.epa.gov/ozone/mbr> or by calling 1-800-296-1996.

There are three major ways you can provide the Agency with proof of your investigative work.

- (1) Conduct and submit your own research
- (2) Cite research that has been conducted by others
- (3) Cite research listed on the EPA website

Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be conducted in a scientifically sound manner. The studies should include a description of the experimental methodology used, such as application rates, application intervals, pest pressure, weather conditions, varieties of the crop used, etc. All results should be included, regardless of outcome. **You must submit copies of each study to EPA** unless they are listed on the Agency website.

The Agency has posted many research studies on a variety of crops on its website and knows of more studies currently in progress. EPA will add studies to its website as they become publicly available. You are encouraged to review the EPA website and other websites for studies that pertain to your crop and geographic area.

In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and therefore no research has been conducted (i.e. solarization may not be feasible in Seattle). You should look at the list of alternatives provided by the Agency and explain why they cannot be used for your crop and in your geographic area.

Use additional pages as needed.

Alternative: Metam-sodium, Dazomet

Study: _____

Section I. Initial Screening on Technical Feasibility of Alternatives

1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?

- | | |
|---|---------------|
| 1a. Full use permitted | _____ X _____ |
| 1b. Township caps | _____ |
| 1c. Alternative not acceptable in consuming country | _____ |
| 1d. Other (Please describe) | _____ |

If use of this alternative is precluded by regulatory restriction for all users covered by this application, the applicant should not complete Section II.

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

Section II. Existing Research Studies on Alternatives to Methyl Bromide

1. Is the study on EPA's website? Yes _____ No X

1a. If not on the EPA website, please attach a copy.

2. Author(s) or researcher(s) Sally J. Campbell and Bruce R. Kelpsas

3. Publication and Date of Publication Tree Planters' Notes v. 39 (1988)

4. Location of research study USDA Forest Service Bend Nursery, Bend, Oregon

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

Metam-sodium, Dazomet

6. Was crop yield measured in the study? Yes X No _____

7. Describe the effectiveness of the alternative in controlling pests in the study.

Only methyl bromide-chloropicrin produced a significant reduction in Fusarium

populations. Pythium was more sensitive than Fusarium, showing significant

reductions at posttreatment and presow times in all treatments compared to the

control. The metam-sodium treatment produced the highest density of seedlings.

8. Discuss how the results of the study apply to your situation. Would you expect similar results? Are there other factors that would affect your adoption of this tool?

Bend Pine Nursery (no longer in business) was a "high desert" nursery which grew

pinus for harsh sites in eastern Oregon and Washington. The soils were sandy

and rocky. The results in Bend would not be applicable to most other nurseries in

this consortium.

Worksheet 3. Alternatives - Feasibility of Alternative Pest Control Regimens

Purpose of Data on Alternative Pest Control Regimens: To estimate the loss as a result of not having methyl bromide available. EPA needs to compare data (yields, crop/commodity prices, gross revenues and costs) on the use of methyl bromide and alternative pest control regimens.

Complete each of the worksheets below (3-A, 3-B, 3-C, and 3-D) for each alternative pest control regimen listed in the "U.S. Matrix" for chemical controls (www.epa.gov/ozone/mbr/cueqa.html) and the "International Matrix" for non-chemical pest controls (www.epa.gov/ozone/mbr/cue). Each worksheet contains a place holder in the title for you to insert the name of the specific alternative pest control regimen addressed. You should add additional worksheets as required. Please add a number designation to each worksheet title to indicate a different alternative. For example, for the first alternative pest control regimen label the worksheets as 3-A(1), 3-B(1), 3-C(1), and 3-D(1). For the second alternative pest control regimen label the worksheets 3-A(2), 3-B(2), 3-C(2), and 3-D(2).

Enter all alternative pesticides and pest control methods (and associated cost and yield data) that would replace one treatment of methyl bromide throughout the fumigation cycle. See the fumigation cycle worksheet for a comprehensive definition.

Worksheet	Title	
3-A	Alternatives - Technical Feasibility	This form is used to obtain information on the chemical alternatives identified by the Methyl Bromide Technical Options Committee (MBTOC) that are registered for use in the United States, as well as the non-chemical alternatives identified by the MBTOC. Applicants must address the technical feasibility of all the chemical and non-chemical alternatives identified on the list.
3-B	Alternatives - Pest Control Regimen Costs	This form is used to estimate the cost of using alternative pest control regimens.
3-C	Alternatives - Crop/Commodity Yield and Gross Revenue	This form is used to estimate the crop/commodity yields and gross revenues when using alternative pest control regimens.
3-D	Alternatives - Changes in Other Costs	This form is used to estimate change in any other costs as a result of using the alternatives.

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous page) is or is not effective for your conditions. This worksheet contains 9 questions. You must complete one copy of worksheet 3-A for each research study you use to evaluate a single methyl bromide alternative. Use additional pages as need.

For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed. Please number the worksheets as follows. For the same alternative, first research study, label the worksheet 3-A(1)(a). For the same alternative, second research study, label the worksheet 3-A(1)(b). For the first alternative, third research study, label the worksheet 3-A(1)(c). For the second alternative, first research study, label the worksheet 3-(A)(2)(a). For the second alternative, second research study, label the worksheet 3-(A)(2)(b).

When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions 1, 5, and 8.

Summarize each of the research studies you cite in the Research Summary Worksheet.

If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more relevant research reports. The narrative review must reply to Section I and questions 1 through 8 in Section II. A Research Summary Worksheet of relevant treatments should be provided for each study reviewed.

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could be used successfully instead of methyl bromide by crop and circumstance (geographic area.) The Agency has developed a list of possible alternative pest control regimens for various crops, which can be found at <http://www.epa.gov/ozone/mbr> or by calling 1-800-296-1996.

There are three major ways you can provide the Agency with proof of your investigative work.

- (1) Conduct and submit your own research
- (2) Cite research that has been conducted by others
- (3) Cite research listed on the EPA website

Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be conducted in a scientifically sound manner. The studies should include a description of the experimental methodology used, such as application rates, application intervals, pest pressure, weather conditions, varieties of the crop used, etc. All results should be included, regardless of outcome. **You must submit copies of each study to EPA** unless they are listed on the Agency website.

The Agency has posted many research studies on a variety of crops on its website and knows of more studies currently in progress. EPA will add studies to its website as they become publicly available. You are encouraged to review the EPA website and other websites for studies that pertain to your crop and geographic area.

In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and therefore no research has been conducted (i.e. solarization may not be feasible in Seattle). You should look at the list of alternatives provided by the Agency and explain why they cannot be used for your crop and in your geographic area.

Use additional pages as needed.

Alternative: [Insert Alternative]

Study: [Insert Study Title]

Section I. Initial Screening on Technical Feasibility of Alternatives**1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?**

- 1a. Full use permitted x
- 1b. Township caps
- 1c. Alternative not acceptable in consuming country
- 1d. Other (Please describe)

If use of this alternative is precluded by regulatory restriction for all users covered by this application, the applicant should not complete Section II.

For EPA Use Only _____

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

Section II. Existing Research Studies on Alternatives to Methyl Bromide

1. Is the study on EPA's website? Yes _____ No X

1a. If not on the EPA website, please attach a copy.

2. Author(s) or researcher(s) R.L. James and K. Beall

3. Publication and Date of Publication USDA Forest Health Protection Report 99-9, June 1999

4. Location of research study USDA Lucky Peak Nursery, Boise, Idaho

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

Dazomet, Fallow

6. Was crop yield measured in the study? Yes X No _____

7. Describe the effectiveness of the alternative in controlling pests in the study.

Fallowing fields for at least one year prior to sowing was as effective as dazomet

Dazomet was not as effective as MBC, possibly due to the high clay soils of the

Density of both tree crops was comparable between MBC and fallow treatments.

was lower in MBC-treated areas.

8. Discuss how the results of the study apply to your situation. Would you expect similar results? Are there other

Results from Lucky Peak would be somewhat applicable to nurseries in colder zones.

The clay content at the nursery is much higher than at most other nurseries, so results

would differ throughout the region.

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

For EPA Use Only
ID#

Research Summary Table

Alternative: Dazomet, Metam SodiumStudy: Comparison of Three Soil Fumigants in a Bareroot Conifer Nursery

Provide one summary table for each study being described.															
Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control, yield or quality of the commodity being treated, or protected. Ideally, a research study should directly compare methyl bromide and the alternative regimen.															
Col. A: Treatment Number	List the treatment number from the research study you are citing.														
Col. B: Treatment	List what type of pest control method was used.														
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.														
Col. D, F, H, J, L, N: Interval	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale (e.g. 0 to 100 where 100 is complete control).														
Cols. E, G, I, K, M, O: Rating for Interval:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode population in the soil pre-treatment, 3 weeks after treatment, and 6 weeks after treatment. In this example, type over the words "Rating Interval 1" with "pre-treatment", type over "Rating Interval 2" with "3 weeks", and type over "Rating Interval 3" with "6 weeks." If you are completing the printed version, please define Rating Interval in the comments below.														
Control of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L header below. In the comments section describe the rating system used (0 to 100 scale where 0 is no control, number of nematodes per gram of soil, number of colony forming units per gram of soil, etc.)														
Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.														
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.															
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Treatment Number	Treatment	Rate (lbs. or gals. ai per area)	Fusarium						Pythium						Yield (units/area)
			Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	
1	Methyl-bromide-chlorop.	350 lbs/ac	pre-trt	1126	2 wks	22	presow	0	pre-trt	98	2 wks	0	presow	2	1,352
2	Metam-sodium	109 gal/ac	pre-trt	554	2 wks	483	presow	616	pre-trt	63	2 wks	3	presow	31	1,760
3	Dazomet	350 lbs/ac	pre-trt	543	2 wks	615	presow	332	pre-trt	73	2 wks	2	presow	34	2,042
4	control	---	pre-trt	843	2 wks	1160	presow	311	pre-trt	85	2 wks	29	presow	85	2,257
Comments:			Ratings are propagules per gram of oven-dry soil Yield is mm3												

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous page) is or is not effective for your conditions. This worksheet contains 9 questions. You must complete one copy of worksheet 3-A for each research study you use to evaluate a single methyl bromide alternative. Use additional pages as need.

For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed. Please number the worksheets as follows. For the same alternative, first research study, label the worksheet 3-A(1)(a). For the same alternative, second research study, label the worksheet 3-A(1)(b). For the first alternative, third research study, label the worksheet 3-A(1)(c). For the second alternative, first research study, label the worksheet 3-(A)(2)(a). For the second alternative, second research study, label the worksheet 3-(A)(2)(b).

When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions 1, 5, and 8.

Summarize each of the research studies you cite in the Research Summary Worksheet.

If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more relevant research reports. The narrative review must reply to Section I and questions 1 through 8 in Section II. A Research Summary Worksheet of relevant treatments should be provided for each study reviewed.

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could be used successfully instead of methyl bromide by crop and circumstance (geographic area.) The Agency has developed a list of possible alternative pest control regimens for various crops, which can be found at <http://www.epa.gov/ozone/mbr> or by calling 1-800-296-1996.

There are three major ways you can provide the Agency with proof of your investigative work.

- (1) Conduct and submit your own research
- (2) Cite research that has been conducted by others
- (3) Cite research listed on the EPA website

Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be conducted in a scientifically sound manner. The studies should include a description of the experimental methodology used, such as application rates, application intervals, pest pressure, weather conditions, varieties of the crop used, etc. All results should be included, regardless of outcome. **You must submit copies of each study to EPA** unless they are listed on the Agency website.

The Agency has posted many research studies on a variety of crops on its website and knows of more studies currently in progress. EPA will add studies to its website as they become publicly available. You are encouraged to review the EPA website and other websites for studies that pertain to your crop and geographic area.

In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and therefore no research has been conducted (i.e. solarization may not be feasible in Seattle). You should look at the list of alternatives provided by the Agency and explain why they cannot be used for your crop and in your geographic area.

Use additional pages as needed.

Alternative: [Insert Alternative]

Study: [Insert Study Title]

Section I. Initial Screening on Technical Feasibility of Alternatives**1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?**

- 1a. Full use permitted x
- 1b. Township caps
- 1c. Alternative not acceptable in consuming country
- 1d. Other (Please describe)

If use of this alternative is precluded by regulatory restriction for all users covered by this application, the applicant should not complete Section II.

For EPA Use Only _____

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

Section II. Existing Research Studies on Alternatives to Methyl Bromide

1. Is the study on EPA's website? Yes _____ No X

1a. If not on the EPA website, please attach a copy.

2. Author(s) or researcher(s) R.L. James and K. Beall

3. Publication and Date of Publication USDA Forest Health Protection Report 99-9, June 1999

4. Location of research study USDA Lucky Peak Nursery, Boise, Idaho

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

Dazomet, Fallow

6. Was crop yield measured in the study? Yes X No _____

7. Describe the effectiveness of the alternative in controlling pests in the study.

Fallowing fields for at least one year prior to sowing was as effective as dazomet

Dazomet was not as effective as MBC, possibly due to the high clay soils of the

Density of both tree crops was comparable between MBC and fallow treatments.

was lower in MBC-treated areas.

8. Discuss how the results of the study apply to your situation. Would you expect similar results? Are there other

Results from Lucky Peak would be somewhat applicable to nurseries in colder zones.

The clay content at the nursery is much higher than at most other nurseries, so results

would differ throughout the region.

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to

For EPA Use Only

Research

Summary

Alternative: **Dazomet, Fallowing**

Study: **An Evaluation of the Effects of Dazomet on Soil-Borne Diseases and
Conifer Seedling Production - USDA FS Lucky Peak Nursery, Boise, Idaho**

Provide one summary table for each study being described.															
Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control, yield or quality of the															
Col. A: Treatment Number	List the treatment number from the research study you are citing.														
Col. B: Treatment	List what type of pest control method was used.														
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.														
Col. D, F, H, J, L, N: Interval	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale (e.g. 0 to 100 where 100 is complete control).														
Cols. E, G, I, K, M, O: Rating for Interval:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode population in the soil pre-treatment, 3 weeks after treatment, and 6 weeks after treatment. In this example, type over the words "Rating Interval 1" with "pre-treatment", type over "Rating Interval 2" with "3 weeks", and type over "Rating Interval 3" with "6 weeks." If you are completing the printed version, please define Rating Interval in the comments below.														
Control of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L header below. In the comments section describe the rating system used (0 to 100 scale where 0 is no control, number of nematodes per gram of soil, number of colony forming units per gram of soil, etc.).														
Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.														
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.															
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Treatment Number	Treatment	Rate (lbs. or gals. ai per area)	T/R ratio						Pythium						Yield (units/area)
			Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	
Ponderosa pine															
1	dazomet	350 lbs/ac	pre-trt	2.1	9 mos.	8.7			pre-trt	3	9 mos.	1			151
2	MBC	*	pre-trt	4.8	9 mos.	125.4			pre-trt	0	9 mos.	0			204
3	Fallow	--	pre-trt	6.6	9 mos.	19.7			pre-trt	2	9 mos.	0			204
Lodgepole pine															
1	dazomet	350 lbs/ac	pre-trt	21.6	9 mos.	4.9			pre-trt	53	9 mos.	4			183
2	MBC	*	pre-trt	8.3	9 mos.	86.2			pre-trt	153	9 mos.	8			215
3	Fallow	--	pre-trt	6.3	9 mos.	7.1			pre-trt	190	9 mos.	150			204

Comments:

* see Stone et al. 1997 for rate applied

Rating for Pest 1 is the ratio of Trichoderma to Fusarium populations (colony-forming units per gram of oven-dried soil)

Rating for Pest 2 is cfu/gram of oven-dried soil. Yield is no. seedlings/m².

OMB Control # 2060-0482

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous page) is or is not effective for your conditions. This worksheet contains 9 questions. **You must complete one copy of worksheet 3-A for each research study you use to evaluate a single methyl bromide alternative.** Use additional pages as need.

For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed. Please number the worksheets as follows. For the same alternative, first research study, label the worksheet 3-A(1)(a). For the same alternative, second research study, label the worksheet 3-A(1)(b). For the first alternative, third research study, label the worksheet 3-A(1)(c). For the second alternative, first research study, label the worksheet 3-A(2)(a). For the second alternative, second research study, label the worksheet 3-A(2)(b).

When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions 1, 5, and 8.

Summarize each of the research studies you cite in the Research Summary Worksheet.

If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more relevant research reports. The narrative review must reply to Section I and questions 1 through 8 in Section II. A Research Summary Worksheet of relevant treatments should be provided for each study reviewed.

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could be used successfully instead of methyl bromide by crop and circumstance (geographic area.) The Agency has developed a list of possible alternative pest control regimens for various crops, which can be found at <http://www.epa.gov/ozone/mbr> or by calling 1-800-296-1996.

There are three major ways you can provide the Agency with proof of your investigative work.

- (1) Conduct and submit your own research
- (2) Cite research that has been conducted by others
- (3) Cite research listed on the EPA website

Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be conducted in a scientifically sound manner. The studies should include a description of the experimental methodology used, such as application rates, application intervals, pest pressure, weather conditions, varieties of the crop used, etc. All results should be included, regardless of outcome. **You must submit copies of each study to EPA** unless they are listed on the Agency website.

The Agency has posted many research studies on a variety of crops on its website and knows of more studies currently in progress. EPA will add studies to its website as they become publicly available. You are encouraged to review the EPA website and other websites for studies that pertain to your crop and geographic area.

In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and therefore no research has been conducted (i.e. solarization may not be feasible in Seattle). You should look at the list of alternatives provided by the Agency and explain why they cannot be used for your crop and in your geographic area.

Use additional pages as needed.

Alternative: [Insert Alternative]

Study: [Insert Study Title]

Section I. Initial Screening on Technical Feasibility of Alternatives**1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?**

- 1a. Full use permitted x
- 1b. Township caps
- 1c. Alternative not acceptable in consuming country
- 1d. Other (Please describe)

If use of this alternative is precluded by regulatory restriction for all users covered by this application, the applicant should not complete Section II.

For EPA Use Only _____

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

Section II. Existing Research Studies on Alternatives to Methyl Bromide

1. Is the study on EPA's website? Yes _____ No X

1a. If not on the EPA website, please attach a copy.

2. Author(s) or researcher(s) Sally J. Cooley

3. Publication and Date of Publication Proceedings: Western For. Nur. Council- Intermountain Nurseryman's
Assoc. Aug. 14-16, 1984

4. Location of research study J. Herbert Stone and Bend Forest Service Nurseries in Oregon

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

solarization

6. Was crop yield measured in the study? Yes X No _____

7. Describe the effectiveness of the alternative in controlling pests in the study.

Fusarium propagules were reduced significantly by solarization after 4 weeks
(at Bend) and 6.5 weeks (J.H. Stone). Solarization produced no significant reductions
in Pythium populations.

8. Discuss how the results of the study apply to your situation. Would you expect similar results? Are there other

Bend Pine Nursery (no longer in business) was a "high desert" nursery which grew
pinus for harsh sites in eastern Oregon and Washington. The soils were sandy
and rocky. The results in Bend would not be applicable to most other nurseries in
this consortium. The results from Stone nursery would be applicable.

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl

For EPA Use Only

Research

Summary

Alternative: Solarization

Study: Solarization in Two Pacific Northwest Forest Nurseries

Provide one summary table for each study being described.	
Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control, yield or quality	
Col. A: Treat ment Numb er	List the treatment number from the research study you are citing.
Col. B: Treat ment	List what type of pest control method was used.
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.
Col. D, F, H, J, L, N: Interv al	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale (e.g. 0 to 100 where 100 is complete control).
Cols. E, G, I, K, M, O: Rating for Interv al:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode population in the soil pre-treatment, 3 weeks after treatment, and 6 weeks after treatment. In this example, type over the words "Rating Interval 1" with "pre-treatment", type over "Rating Interval 2" with "3 weeks", and type over "Rating Interval 3" with "6 weeks." If you are completing the printed version, please define Rating Interval in the comments below.
Contr ol of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L header below. In the comments section describe the rating system used (0 to 100 scale where 0 is no control, number of nematodes per gram of soil, number of colony forming units per gram of soil, etc.).

Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.														
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.															
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Treatment Number	Treatment	Rate (lbs. or gals. ai per area)	Fusarium						Pythium						Yield (units/area)
			Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	
Stone Nurs	0-6"														
1	control	--	pre-trt	2320	6.5 wks	3400			pre-trt	180	6.5 wks	136			16
2	solarization	6.5 wks	pre-trt	2640	6.5 wks	920			pre-trt	184	6.5 wks	144			17
3	MBR	350 lbs/ac	pre-trt	2680	6.5 wks	0			pre-trt	194	6.5 wks	0			23
	6-12"														
4	control	--	pre-trt	1880	6.5 wks	2760			pre-trt	188	6.5 wks	146			16
5	solarization	6.5 wks	pre-trt	2040	6.5 wks	1120			pre-trt	184	6.5 wks	128			17
6	MBR	350 lbs/ac	pre-trt	2600	6.5 wks	80			pre-trt	208	6.5 wks	0			23
Comments: Ratings are propagules/ gram of soil. Yield is Trees/ft2.															
Similar results for Fusarium were obtained at another nursery in Bend, Oregon (data not published). Pythium was not measured at this other site.															

OMB Control # 2060-0482

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous page) is or is not effective for your conditions. This worksheet contains 9 questions. You must complete one copy of worksheet 3-A for each research study you use to evaluate a single methyl bromide alternative. Use additional pages as need.

For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed. Please number the worksheets as follows. For the same alternative, first research study, label the worksheet 3-A(1)(a). For the same alternative, second research study, label the worksheet 3-A(1)(b). For the first alternative, third research study, label the worksheet 3-A(1)(c). For the second alternative, first research study, label the worksheet 3-(A)(2)(a). For the second alternative, second research study, label the worksheet 3-(A)(2)(b).

When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions 1, 5, and 8.

Summarize each of the research studies you cite in the Research Summary Worksheet.

If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more relevant research reports. The narrative review must reply to Section I and questions 1 through 8 in Section II. A Research Summary Worksheet of relevant treatments should be provided for each study reviewed.

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could be used successfully instead of methyl bromide by crop and circumstance (geographic area.) The Agency has developed a list of possible alternative pest control regimens for various crops, which can be found at <http://www.epa.gov/ozone/mbr> or by calling 1-800-296-1996.

There are three major ways you can provide the Agency with proof of your investigative work.

- (1) Conduct and submit your own research
- (2) Cite research that has been conducted by others
- (3) Cite research listed on the EPA website

Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be conducted in a scientifically sound manner. The studies should include a description of the experimental methodology used, such as application rates, application intervals, pest pressure, weather conditions, varieties of the crop used, etc. All results should be included, regardless of outcome. **You must submit copies of each study to EPA** unless they are listed on the Agency website.

The Agency has posted many research studies on a variety of crops on its website and knows of more studies currently in progress. EPA will add studies to its website as they become publicly available. You are encouraged to review the EPA website and other websites for studies that pertain to your crop and geographic area.

In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and therefore no research has been conducted (i.e. solarization may not be feasible in Seattle). You should look at the list of alternatives provided by the Agency and explain why they cannot be used for your crop and in your geographic area.

Use additional pages as needed.

Alternative: _____

Study: _____

Section I. Initial Screening on Technical Feasibility of Alternatives**1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?**

- 1a. Full use permitted X
- 1b. Township caps _____
- 1c. Alternative not acceptable in consuming country _____
- 1d. Other (Please describe) _____

If use of this alternative is precluded by regulatory restriction for all users covered by this application, the applicant should not complete Section II.

For EPA Use Only

ID# _____

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

Section II. Existing Research Studies on Alternatives to Methyl Bromide

1. Is the study on EPA's website? Yes X No X

1a. If not on the EPA website, please attach a copy.

2. Author(s) or researcher(s) Jeffrey K. Stone, Diane M. Hildebrand, Robert L. James, Susan M. Frankel
David S. Germandt

Alternatives to Methyl Bromide for control of Soil-borne Diseases in Bare Root Nurseries

3. Publication and Date of Publication FID Tech Rep. R6-06-02, www.epa.gov/spdpublic/mbr/airc/1995/077.pdf

4. Location of research study Bend Pine Nursery, Bend, Oreogn

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

Pea cover crop & MBC, Bare Fallow with Tillage, Bare Fallow with no Till

Pea cover crop & no fumigation

6. Was crop yield measured in the study? Yes X No _____

7. Describe the effectiveness of the alternative in controlling pests in the study.

Average seedling densities and mortality were not significantly different between the

fumigated and the bare fallow treatments. The pea cover crop without fumigation

resulted in significantly lower densities and significantly higher mortality in both trials.

In the 1993 trial, seedling diameter and shoot height was significantly greater in the

MBR treatment than the bare fallow treatments, but was not significant in 1995.

Average preplant levels of Fusarium were not significantly different between the bare

fallow treatments and the fumigated treatment. Pea plant cover exacerbated disease.

8. Discuss how the results of the study apply to your situation. Would you expect similar results? Are there other factors that would affect your adoption of this tool?

Bend Pine Nursery (no longer in business) was a "high desert" nursery which grew

pinus for harsh sites in eastern Oregon and Washington. The soils were sandy

and rocky. The results in Bend would not be applicable to most other nurseries in

this consortium.

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to

For EPA Use Only

Research

Alternative: Pea cover, bare fallow, tillage, MBC

Study: Alternatives to Methyl Bromide for control of Soil-Borne Diseases
in Bare Root Forest Nurseries

Provide one summary table for each study being described.	
Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control,	
Col. A: Treat ment Numb er	List the treatment number from the research study you are citing.
Col. B: Treat ment	List what type of pest control method was used.
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.
Col. D, F, H, J, L, N: Interv al	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale (e.g. 0 to 100 where 100 is complete control).
Cols. E, G, I, K, M, O: Rating for Interv al:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode population in the soil pre-treatment, 3 weeks after treatment, and 6 weeks after treatment. In this example, type over the words "Rating Interval 1" with "pre-treatment", type over "Rating Interval 2" with "3 weeks", and type over "Rating Interval 3" with "6 weeks." If you are completing the printed version, please define Rating Interval in the comments below.

Control of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L header below. In the comments section describe the rating system used (0 to 100 scale where 0 is no control, number of nematodes per gram of soil, number of colony forming units per gram of soil, etc.).														
Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.														
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications															
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Trtmnt Number	Treatment	Rate (lbs. or gals. ai per area)	Fusarium						Pythium						Yield (units/area)
			Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	
1	Peas.MBC	350lbs/ac	pre-sow	170					pre-sow	1.6					21
2	BF+Tillage	--	pre-sow	618					pre-sow	14.2					22
3	BF- no till	--	pre-sow	948					pre-sow	17.6					22
4	Peas, no Fum	--	pre-sow	3711					pre-sow	157.7					7
Comments:			BF= Bare fallow June-Sept. Tillage=every 3 weeks Rating is colony-forming units per gram dry weight of soil. Density is 2+0 seedlings per sq. meter Aged pine sawdust and amendments of NH4NO3 were added to all treatments												

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous page) is or is not feasible. For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed. Please number each alternative and research study. When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions 1, 5, and 8. Summarize each of the research studies you cite in the Research Summary Worksheet. If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more relevant studies.

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could be used. There are three major ways you can provide the Agency with proof of your investigative work. Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be conducted in a way that the Agency has posted many research studies on a variety of crops on its website and knows of more studies currently in progress. In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and therefore no research is needed. Use additional pages as needed.

Alternative: [Insert Alternative]Study: [Insert Study Title]**Section I. Initial Screening on Technical Feasibility of Alternatives****1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?**

- 1a. Full use permitted X
 1b. Township caps
 1c. Alternative not acceptable in consuming country
 1d. Other (Please describe)

If use of this alternative is precluded by regulatory restriction for all users covered by this application, the
 For EPA Use Only _____

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide**Section II. Existing Research Studies on Alternatives to Methyl Bromide****1. Is the study on EPA's website? Yes X No X**

1a. If not on the EPA website, please attach a copy.

2. Author(s) or researcher(s) 2 papers
Jeffrey K. Stone, Diane M. Hildebrand, Robert L. James, Susan M. Frankel
David S. Germandt

3. Publication and Date of Publication Alternatives to Methyl Bromide for control of Soil-borne Diseases in Bare Root Nurseries
FID Tech Rep. R6-06-02, www.epa.gov/spdpublic/mbr/airc/1995/077.pdf

4. Location of research study J. Herbert Stone Nursery, Oregon

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

sawdust soil amendment, ammonium nitrate, bare fallow, tillage, Dazomet, no-tillage

6. Was crop yield measured in the study? Yes X No**7. Describe the effectiveness of the alternative in controlling pests in the study.**

year.
Bare fallow without tillage also produced shorter seedlings in 1993, but not 1995, compared to all other
of
without
till treatments had similar mortalities in 1995 and were not significantly different from one another.
The lowest mortalities in the 1995 trial were found in the bare fallow with tillage and the sawdust,
bare fallow-till, delayed nitrogen treatment. Higher weeds were noted in bare fallow without tillage in 1993.

8. Discuss how the results of the study apply to your situation. Would you expect similar results? Are there other factors
Results from Stone nursery would possibly apply to most nurseries in the Pacific
Northwest.

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

For EPA Use Only

Research Summary Table

Alternative: sawdust+ammonium, bare fallow with till, bare fallow (no-till)
delayed nitrogen, nitrogen, dazomet

Study: Alternatives to Methyl Bromide for control of Soil-Borne Diseases
in Bare Root Forest Nurseries

Provide one summary table for each study being described.															
Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control, yield or quality of the commodity being treated, or															
Col. A: Treatment Number	List the treatment number from the research study you are citing.														
Col. B: Treatment	List what type of pest control method was used.														
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.														
Col. D, F, H, J, L, N: Interval	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale (e.g. 0 to 100 where 100 is complete control).														
Cols. E, G, I, K, M, O: Rating for Interval:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode population in the soil pre-treatment, 3 weeks after treatment, and 6 weeks after treatment. In this example, type over the words "Rating Interval 1" with "pre-treatment", type over "Rating Interval 2" with "3 weeks", and type over "Rating Interval 3" with "6 weeks." If you are completing the printed version, please define Rating Interval in the comments below.														
Control of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L header below. In the comments section describe the rating system used (0 to 100 scale where 0 is no control, number of nematodes per gram of soil, number of colony forming units per gram of soil, etc.).														
Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.														
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.															
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Treatment Number	Treatment	Rate (lbs. or gals. ai per area)	Fusarium						Pythium						Yield (units/area)
			Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	
ponderosa pine															
1	S+N, BFT, Dazomet	350 lb/ac	1993-95	135	1995-98	866			1993-95	19	1995-98	4			165
2	S+N, BFT	250 m3/ha (S)	1993-95	2194	1995-98	7988			1993-95	22	1995-98	60			164
3	S+N, BF	300 lb/ac (N)	1993-95	3469	1995-98	4796			1993-95	82	1995-98	45			168
4	BFT	every 3 wks	1993-95	1106	1995-98	4303			1993-95	56	1995-98	46			145
5	S, BFT, delayed nitrogen		1993-95	808	1995-98	2653			1993-95	67	1995-98	46			169
Comments:	Ratings are colony-forming units per gram dry weight of soil BF=bare fallow, T=with tilling, S=sawdust soil amendment, N=ammonium nitrate Yield is 2+0 seedlings per m2														

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous page) is or is not feasible. For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed. Please number each alternative and research study. When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions 1, 5, and 8. Summarize each of the research studies you cite in the Research Summary Worksheet. If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more relevant studies.

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could be used. There are three major ways you can provide the Agency with proof of your investigative work. Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be conducted in a way that the Agency has posted many research studies on a variety of crops on its website and knows of more studies currently in progress. In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and therefore no research is needed. Use additional pages as needed.

Alternative: bare fallow tillage, dazomet
bark compost, sludge

Study: Alternatives to methyl bromide for control of soil-borne
diseases in bare root forest nurseries

Section I. Initial Screening on Technical Feasibility of Alternatives**1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?**

- 1a. Full use permitted _____
 1b. Township caps _____
 1c. Alternative not acceptable in consuming country _____
 1d. Other (Please describe) _____

If use of this alternative is precluded by regulatory restriction for all users covered by this application, the
For EPA Use Only _____

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide**Section II. Existing Research Studies on Alternatives to Methyl Bromide****1. Is the study on EPA's website? Yes X No X**

1a. If not on the EPA website, please attach a copy.

2. Author(s) or researcher(s) 2 papers
Stone et al. 1995
Hildebrand et al. 2002

3. Publication and Date of Publication FID Tech. Rep. R6-02-02, 2002,
www.epa.gov/spdpub/mbr/airc/1995/077.pdf

4. Location of research study Coeur d'Alene Nursery, Coeur d'Alene, Idaho

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

bare fallow with tillage, dazomet, bark compost, sludge

6. Was crop yield measured in the study? Yes X No _____**7. Describe the effectiveness of the alternative in controlling pests in the study.**

Seedling densities were not significantly affected by any treatment. Bark compost and sewage sludge
amendments produced the shortest seedlings and the lowest diameters, while dazomet treatment still
had greater height than the bare fallow without amendment treatment.

8. Discuss how the results of the study apply to your situation. Would you expect similar results? Are there

Results from Coeur d'Alene nursery would be applicable to most northern region
nurseries, as well as areas in the Pacific Northwest.

OMB Control # 2060-0482

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

For EPA Use Only

Research Summary Table

Alternative: bare fallow, tillage, dazomet, bark compost, sludge

Study: Alternatives to methyl bromide for control of soil-borne diseases in bare root for nurseries.

Provide one summary table for each study being described.															
Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control, yield or quality of the commodity being treated, or protected. Ideally, a															
Col. A: Treatment Number	List the treatment number from the research study you are citing.														
Col. B: Treatment	List what type of pest control method was used.														
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.														
Col. D, F, H, J, L, N:	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale (e.g. 0														
Cols. E, G, I, K, M, O:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode														
Rating for Interval:	population in the soil pre-treatment, 3 weeks after treatment, and 6 weeks after treatment. In this example, type over the words "Rating Interval 1" with "pre-treatment", type over "Rating Interval 2" with "3														
Control of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L header														
Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.														
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.															
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Treatment Number	Treatment	Rate (lbs. or gals. ai per area)	preplant Fusarium						preplant Pythium				Yield (units/area)		
			Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	
Douglas-fir															
1	bare fallow tillage, Dazomet	350 lb/ac	1993-95	73	1995-98	115			1993-95	12	1995-98	3			291
2	bare fallow tillage, bark compost	55 m3/ha	1993-95	217	1995-98	338			1993-95	26	1995-98	35			319
3	bare fallow tillage	periodic tilling	1993-95	172	1995-98	530			1993-95	31	1995-98	38			292
4	bare fallow tillage, sludge	55 m3/ha	1993-95	2180	1995-98	472			1993-95	41	1995-98	38			357
5	bare fallow tillage, pine mulch	periodic tilling	1993-95	1329	1995-98	--			1993-95	--	1995-98	--			--
Comments:															
Ratings are colony-forming units per gram dry weight of soil Yield is 2+0 Seedlings per square meter in 1998															

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous page) is or is not technically feasible. For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed. Please number each alternative and research study. When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions 1, 5, and 8. Summarize each of the research studies you cite in the Research Summary Worksheet. If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more relevant studies.

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could be used. There are three major ways you can provide the Agency with proof of your investigative work. Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be conducted in a way that the Agency can understand and use. The Agency has posted many research studies on a variety of crops on its website and knows of more studies currently in progress. In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and therefore no research is needed. Use additional pages as needed.

Alternative: bare fallow tillage, bare fallow, bare fallow & compost, bare fallow sawdust nitrogen, bare fallow & MBC **Study:** Alternatives to methyl bromide for control of soil-borne diseases in bare-root forest nurseries

Section I. Initial Screening on Technical Feasibility of Alternatives**1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?**

- 1a. Full use permitted _____
 1b. Township caps _____
 1c. Alternative not acceptable in consuming country _____
 1d. Other (Please describe) _____

If use of this alternative is precluded by regulatory restriction for all users covered by this application, the
 For EPA Use Only _____

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide**Section II. Existing Research Studies on Alternatives to Methyl Bromide**

1. Is the study on EPA's website? Yes X No X

1a. If not on the EPA website, please attach a copy.

2. Author(s) or researcher(s) Stone et al. 1995, Hildebrand et al. 2002

3. Publication and Date of Publication FID Tech. Rep. R6-02-02 (2002),
 1995 www.epa.gov/spdpublic/mbr/airc/1995/077.pdf

4. Location of research study Lucky Peak Nursery, near Boise, Idaho

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

bare fallow tillage, bare fallow, bare fallow +compost
 bare fallow + sawdust + nitrogen, bare fallow + MBC

6. Was crop yield measured in the study? Yes X No _____

7. Describe the effectiveness of the alternative in controlling pests in the study.

Seedling density was significantly greater for the bare fallow with sawdust treatment.
 Seedling diameters were smaller in the mushroom and sawdust treatments. Seedling
 height were significantly greater in the bare fallow and MBC treatments than soil
 amendment treatments.

8. Discuss how the results of the study apply to your situation. Would you expect similar results? Are there

Results from Lucky Peak would be somewhat applicable to nurseries in colder zones.

The clay content at the nursery is much higher than at most other nurseries, so results would differ throughout the region.

OMB Control # 2060-0482

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

For EPA Use Only

Research Summary Table

Alternative: bare fallow till, bare fallow, bare fallow + compost,
bare fallow sawdust + nitrogen, bare fallow + MBC

Study: Alternatives to Methyl bromide for control of soil-borne
diseases in bare root forest nurseries

Provide one summary table for each study being described.															
Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control, yield or quality of the commodity being treated, or protected.															
Col. A: Treatment Number	List the treatment number from the research study you are citing.														
Col. B: Treatment	List what type of pest control method was used.														
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.														
Col. D, F, H, J, L, N: Interval	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale														
Cols. E, G, I, K, M, O: Rating for Interval:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode population in the soil pre-treatment, 3 weeks after treatment, and 6 weeks after treatment. In this example, type over the words "Rating Interval 1" with "pre-treatment", type over "Rating														
Control of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L														
Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.														
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.															
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Treatment Number	Treatment	Rate (lbs. or gals. ai per area)	Preplant Fusarium						Preplant Pythium						Yield (units/area)
			Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	
Ponderosa pine															
1	bare fallow tillage	--	1993-95	496	1995-98	376			1993-95	25	1995-98	21			340
2	bare fallow	--	1993-95	241	1995-98	488			1993-95	38	1995-98	29			284
3	bare fallow + compost	42 m3/ha	1993-95	227	1995-98	434			1993-95	24	1995-98	32			306
4	bare fallow, sawdust + nitrogen	*	1993-95	214	1995-98	341			1993-95	21	1995-98	27			372
5	bare fallow + MBC	393 kg/ha	1993-95	80	1995-98	65			1993-95	7	1995-98	4			343
Comments:			* sawdust containing supplemental nitrogen at 42 m3/ha, with ammonium nitrate fertilizer added at 92 kg/ha Ratings are colony-forming units per gram dry weight of soil Yield is 2+0 seedlings per square meter in 1998												

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous page) is or is not technically feasible. For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed. Please number each alternative and research study. When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions 1, 5, and 8. Summarize each of the research studies you cite in the Research Summary Worksheet. If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more relevant studies.

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could be used. There are three major ways you can provide the Agency with proof of your investigative work. Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be conducted in a way that the Agency has posted many research studies on a variety of crops on its website and knows of more studies currently in progress. In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and therefore no research is needed. Use additional pages as needed.

Alternative: bare fallow tillage, bare fallow, bare fallow & compost, **Study:** Alternatives to methyl bromide for control of soil-borne diseases in bare-root forest nurseries
bare fallow sawdust nitrogen, bare fallow & MBC

Section I. Initial Screening on Technical Feasibility of Alternatives**1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?**

- 1a. Full use permitted _____
 1b. Township caps _____
 1c. Alternative not acceptable in consuming country _____
 1d. Other (Please describe) _____

If use of this alternative is precluded by regulatory restriction for all users covered by this application, the
 For EPA Use Only _____

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide**Section II. Existing Research Studies on Alternatives to Methyl Bromide**

1. Is the study on EPA's website? Yes X No X

1a. If not on the EPA website, please attach a copy.

2. Author(s) or researcher(s) Stone et al. 1995, Hildebrand et al. 2002

3. Publication and Date of Publication FID Tech. Rep. R6-02-02 (2002),

1995 www.epa.gov/spdpublic/mbr/airc/1995/077.pdf

4. Location of research study Placerville Nursery, Placerville, CA

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

1) bare fallow/till, rice straw, late sow, soil cover; 2) bare fallow/till, rice straw, early
 hydromulch; 3) bare fallow/till, sawdust, early sow, hydromulch; 4) bare fallow/till,
 early sow, sawdust; 5) bare fallow/till, pine needles, early sow, hydromulch; 6) bare
 till, hydromulch, early sow, hydromulch; 7) bare fallow/till, bare soil, early sow, hydromulch

6. Was crop yield measured in the study? Yes X No _____

7. Describe the effectiveness of the alternative in controlling pests in the study.

Late sowing with soil covering the seed resulted in significantly lower seedling density
 and greater mortality caused by disease, compared to treatments with sowing seed
 early and shallow, with a non-soil mulch covering the seed. Seedling root volume,
 and height were not significantly different after one growing season.

8. Discuss how the results of the study apply to your situation. Would you expect similar results? Are there
Results from Placerville would be applicable throughout California and the southwest.

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

For EPA Use Only

Research Summary Table

Alternative: bare fallow till, bare fallow, bare fallow + compost,
bare fallow sawdust + nitrogen, bare fallow + MBC

Study: Alternatives to Methyl bromide for control of soil-borne
diseases in bare root forest nurseries

Provide one summary table for each study being described.															
Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control, yield or quality of the commodity being treated, or protected.															
Col. A: Treatment Number	List the treatment number from the research study you are citing.														
Col. B: Treatment	List what type of pest control method was used.														
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.														
Col. D, F, H, J, L, N:	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale														
Cols. E, G, I, K, M, O:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode population in the soil pre-treatment, 3 weeks after treatment, and 6 weeks after treatment. In this example, type over the words "Rating Interval 1" with "pre-treatment", type over "Rating														
Rating for Interval:															
Control of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L														
Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.														
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.															
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Treatment Number	Treatment	Rate (lbs. or gals. ai per area)	Preplant Fusarium												Yield (units/area)
			Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	
Shasta red fir															
1	BFT, Rice straw, Late sow, Soil cover		1993-95	5285											19
2	BFT, Rice straw, Early sow, Hydromulch		1993-95	4460											30
3	BFT, sawdust, Early sow, Hydromulch		1993-95	3821											27
4	BFT, sawdust, Early sow, sawdust		1993-95	3244											28
5	BFT, pine needles, Early sow, Hydromulch		1993-95	4708											26
	BFT, Hydromulch, Early sow, Hydromulch		1993-95	5406											26
	BFT, Bare, Early sow, Hydromulch		1993-95	3233											24
Comments: Ratings are colony-forming units per gram dry weight of soil Yield is 2+0 seedlings per square foot															

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous page) is or is not feasible. For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed. Please number each alternative and research study. When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions 1, 5, and 8. Summarize each of the research studies you cite in the Research Summary Worksheet. If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more relevant studies.

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could be used. There are three major ways you can provide the Agency with proof of your investigative work. Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be conducted in a way that the Agency has posted many research studies on a variety of crops on its website and knows of more studies currently in progress. In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and therefore no research is needed. Use additional pages as needed.

Alternative: bare fallow tillage, bare fallow, bare fallow & compost, **Study:** Alternatives to methyl bromide for control of soil-borne diseases in bare-root forest nurseries
bare fallow sawdust nitrogen, bare fallow & MBC

Section I. Initial Screening on Technical Feasibility of Alternatives**1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?**

- 1a. Full use permitted _____ X _____
 1b. Township caps _____
 1c. Alternative not acceptable in consuming country _____
 1d. Other (Please describe) _____

If use of this alternative is precluded by regulatory restriction for all users covered by this application, the
 For EPA Use Only _____

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide**Section II. Existing Research Studies on Alternatives to Methyl Bromide**

1. Is the study on EPA's website? Yes X No X

1a. If not on the EPA website, please attach a copy.

2. Author(s) or researcher(s) Stone et al. 1995, Hildebrand et al. 2002

3. Publication and Date of Publication FID Tech. Rep. R6-02-02 (2002),

1995 www.epa.gov/spdpublic/mbr/airc/1995/077.pdf

4. Location of research study Placerville Nursery, Placerville, CA

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

1) bare fallow/till, sawdust, early sow, sawdust cover; 2) bare fallow/till, sawdust, early soil; 3) bare fallow/till, MBC, Vetch, late sow, sawdust; 4) bare fallow/till, vetch, late sawdust; 5) bare fallow/till, hydromulch, late sow, sawdust; 6) bare fallow/till, MBC, late sow, soil; 7) bare fallow/till, vetch, late sow, soil; 8) bare fallow/till, hydromulch, late sow, soil

6. Was crop yield measured in the study? Yes X No _____

7. Describe the effectiveness of the alternative in controlling pests in the study.

Vetch cover crop treatments resulted in crop failure.

The best treatments included bare fallow with tilling, sawdust mulch over the winter, early sowing.

8. Discuss how the results of the study apply to your situation. Would you expect similar results? Are there
Results from Placerville would be applicable throughout California and the southwest.

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

For EPA Use Only

Research Summary Table

Alternative: bare fallow till, bare fallow, bare fallow + compost,
bare fallow sawdust + nitrogen, bare fallow + MBC

Study: Alternatives to Methyl bromide for control of soil-borne
diseases in bare root forest nurseries

Provide one summary table for each study being described.															
Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control, yield or quality of the commodity being treated, or protected.															
Col. A: Treatment Number	List the treatment number from the research study you are citing.														
Col. B: Treatment	List what type of pest control method was used.														
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.														
Col. D, F, H, J, L, N:	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale														
Cols. E, G, I, K, M, O:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode population in the soil pre-treatment, 3 weeks after treatment, and 6 weeks after treatment. In this example, type over the words "Rating Interval 1" with "pre-treatment", type over "Rating														
Control of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L														
Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.														
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.															
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Treatment Number	Treatment	Rate (lbs. or gals. ai per area)	Preplant Fusarium						Preplant Pythium						Yield (units/area)
			Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	
Shasta red fir															
1	BFT, sawdust, Early sow, sawdust		1995-98	3860					1995-98	48.7					39.7
2	BFT, sawdust, Early sow, soil		1995-98	2653					1995-98	55					25.2
3	BFT, MBC, vetch, late sow, sawdust		1995-98	3806					1995-98	71.4					17.9
4	BFT, vetch, late sow, sawdust		1995-98	993					1995-98	56.8					failure
5	BFT, hydromulch, late sow, sawdust		1995-98	653					1995-98	67					16.3
6	BFT, MBC, vetch, late sow, soil		1995-98	927					1995-98	72					11.2
7	BFT, vetch, late sow, soil		1995-98	690					1995-98	71					failure
8	BFT, hydromulch, late sow, soil		1995-98	5774					1995-98	63.6					4.4
Comments:															
Ratings are colony-forming units per gram dry weight of soil Yield is 2+0 seedlings per square foot															

OMB Control # 2060-0482

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous page) is or is not feasible. For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed. Please number each alternative and research study. When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions 1, 5, and 8. Summarize each of the research studies you cite in the Research Summary Worksheet. If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more relevant studies.

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could be used. There are three major ways you can provide the Agency with proof of your investigative work. Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be conducted in a way that the Agency has posted many research studies on a variety of crops on its website and knows of more studies currently in progress. In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and therefore no research is needed. Use additional pages as needed.

Alternative: bare fallow tillage (BFT), BFT & compost, BFT & hydromulch
BFT & MBC, BFT & Dazomet

Study: Alternatives to methyl bromide for control of soil-borne diseases in bare-root forest nurseries

Section I. Initial Screening on Technical Feasibility of Alternatives**1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?**

- 1a. Full use permitted _____ X _____
 1b. Township caps _____
 1c. Alternative not acceptable in consuming country _____
 1d. Other (Please describe) _____

If use of this alternative is precluded by regulatory restriction for all users covered by this application, the
For EPA Use Only _____

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide**Section II. Existing Research Studies on Alternatives to Methyl Bromide**

1. Is the study on EPA's website? Yes X No X

1a. If not on the EPA website, please attach a copy.

2. Author(s) or researcher(s) Stone et al. 1995, Hildebrand et al. 2002

3. Publication and Date of Publication FID Tech. Rep. R6-02-02 (2002),
1995 www.epa.gov/spdpublic/mbr/airc/1995/077.pdf

4. Location of research study Humboldt Nursery, near McKinleyville, California

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

- 1) bare fallow/till; 2) bare fallow/till & compost; 3) bare fallow/till & hydromulch
 4) bare fallow/till & MBC; 5) bare fallow/till & dazomet

6. Was crop yield measured in the study? Yes X No _____

7. Describe the effectiveness of the alternative in controlling pests in the study.

Seedling density, root volume, and height did not vary significantly among treatments.
 Trends in the data indicate that bare fallow with tilling and hydromulch treatment
 resulted in 2 seedlings per square foot more than the bare fallow with tilling with or
 without composted redbud chip mulch.

8. Discuss how the results of the study apply to your situation. Would you expect similar results? Are there
Results from Humboldt would be applicable throughout California and to coastal
nurseries.

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

For EPA Use Only

Research Summary Table

Alternative: bare fallow/till (BFT), BFT + compost, , BFT + hydromulch
BFT + MBC, BFT + Dazomet

Study: Alternatives to Methyl bromide for control of soil-borne
diseases in bare root forest nurseries

Provide one summary table for each study being described.															
Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control, yield or quality of the commodity being treated, or protected. Ideally, a															
Col. A: Treatment Number	List the treatment number from the research study you are citing.														
Col. B: Treatment	List what type of pest control method was used.														
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.														
Col. D, F, H, J, L, N: Interval	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale (e.g. 0														
Cols. E, G, I, K, M, O: Rating for Interval:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode population in the soil pre-treatment, 3 weeks after treatment, and 6 weeks after treatment. In this example, type over the words "Rating Interval 1" with "pre-treatment", type over "Rating Inter														
Control of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L header														
Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.														
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.															
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Treatment Number	Treatment	Rate (lbs. or gals. ai per area)	Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	Yield (units/area)
Shasta red fir															
1	BFT		1993-95												19.3
2	BFT, compost		1993-95												19.6
3	BFT, hydromulch		1993-95												21.6
4	BFT, MBC		1993-95												20.1
5	BFT, Dazomet		1993-95												20.1
Comments:															
Yield is 1+0 seedlings per square foot															

OMB Control # 2060-0482

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl

In this worksheet, you should address why an alternative pest management strategy on the list (see previous page) is or is not feasible.

For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed. Please

When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions 1, 5, and 8.

Summarize each of the research studies you cite in the Research Summary Worksheet.

If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more relevant

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could be used. There are three major ways you can provide the Agency with proof of your investigative work. Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be conducted in a way that the Agency has posted many research studies on a variety of crops on its website and knows of more studies currently in progress. In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and therefore no

Use additional pages as needed.

Alternative: bare fallow + herbicide, bare fallow/till (BFT) + phosphate, buffer
bare fallow, BFT + MBC, BFT + biocontrol

Study: Alternatives to methyl bromide for control of soil-borne diseases in bare-root forest nurseries

Section I. Initial Screening on Technical Feasibility of Alternatives**1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?**

- 1a. Full use permitted X
- 1b. Township caps
- 1c. Alternative not acceptable in consuming country
- 1d. Other (Please describe)

If use of this alternative is precluded by regulatory restriction for all users covered by this application, the

For EPA Use Only _____

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl**Section II. Existing Research Studies on Alternatives to Methyl Bromide****1. Is the study on EPA's website? Yes X No X**

1a. If not on the EPA website, please attach a copy.

2. Author(s) or researcher(s) Stone et al. 1995, Hildebrand et al. 2002

3. Publication and Date of Publication FID Tech. Rep. R6-02-02 (2002),
1995 www.epa.gov/spdpublish/mbr/airc/1995/077.pdf

4. Location of research study Humboldt Nursery, near McKinleyville, California

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

- 1) bare fallow + herbicide; 2) bare fallow/till & phosphate; 3) buffer
- 4) bare fallow; 5) BFT + MBC; 6) BFT + biocontrol
- _____

6. Was crop yield measured in the study? Yes X No**7. Describe the effectiveness of the alternative in controlling pests in the study.**

Bare fallow with tilling and bare fallow with phosphate buffer resulted in less height

the treatment with MBC fumigation (significant $p < 0.05$). Although not significant, the

MBC fumigation treatment had the lowest density compared to the other treatments,
possibly due to a density effect. Pre sow population levels of *Pythium* and *Fusarium*
species did not correlate with seedling density.

- 8. Discuss how the results of the study apply to your situation. Would you expect similar results? Are there other**
Results from Humboldt would be applicable throughout California and to coastal
nurseries.

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

For EPA Use Only

Research Summary Table

Alternative: bare fallow+herbicide, bare fallow/till (BFT) + phosphate buffer
bare fallow, BFT+MBC, BFT+biocontrol

Study: Alternatives to Methyl bromide for control of soil-borne
diseases in bare root forest nurseries

Provide one summary table for each study being described.															
Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control, yield or quality of the commodity being treated, or protected. Ideally, a															
Col. A: Treatment Number	List the treatment number from the research study you are citing.														
Col. B: Treatment	List what type of pest control method was used.														
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.														
Col. D, F, H, J, L, N: Interval	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale (e.g. 0														
Cols. E, G, I, K, M, O: Rating for Interval:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode population in the soil pre-treatment, 3 weeks after treatment, and 6 weeks after treatment. In this example, type over the words "Rating Interval 1" with "pre-treatment", type over "Rating Inter														
Control of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L header														
Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.														
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.															
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Treatment Number	Treatment	Rate (lbs. or gals. ai per area)	Preplant Fusarium						Preplant Pythium						Yield (units/area)
			Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	Interval 1	Rating for Interval 1	Interval 2	Rating for Interval 2	Interval 3	Rating for Interval 3	
Shasta red fir															
1	BFT + herbicide		1995-98	1330						1995-98	286				7.2
2	BFT + phosphate buffer		1995-98	1430						1995-98	272				6.6
3	BF		1995-98	1300						1995-98	232				6.9
4	BFT MBC		1995-98	0						1995-98	3				5.2
5	BFT biocontrol		1995-98	1330						1995-98	323				7.3
Comments: Ratings are colony-forming units per gram dry weight of soil Yield is 2+0 seedlings per square foot															

OMB Control # 2060-0482

Worksheet 3-B. Alternatives - Pest Control Regimen Costs for Alternative:

Basamid

If a consortium is submitting this application, the data for this table should reflect a representative user .													
Col. A: Name of Product and Non-chemical Control	Enter all alternatives and non-chemical pest control that would replace one treatment of methyl bromide throughout the fumigation cycle. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle. If multiple crops are grown during the interval between fumigations (e.g. tomatoes followed by peppers in a single growing season, or strawberries followed by lettuce over 2 or 3 years) include all of the pesticides that replace methyl bromide for the entire interval. Do not include pesticides that are used along with methyl bromide--enter only the additional pest control if methyl bromide were not available. If someone other than the applicant previously benefited from the application of methyl bromide in the fumigation cycle and you do not have the quantitative data for the crops grown on the same land, please indicate so in the comments section below.												
Col. B: Target Pests	Be as specific as possible regarding the species or classes of pests controlled by the active ingredient or pesticide product.												
Col. C: Active Ingredients	Use one row for each active ingredient (ai). For example, if a product contains 2 ai's use 2 rows for that product. Once a row is completed for a given product, then only Col. B (if applicable), C, and E need to be completed for additional rows regarding the same product.												
Col. D: Formulation	Enter the formulation or the % of active ingredient.												
Col. E, F, G: Application Rate	As a cross check, EPA is requesting both the amount of active ingredient in Col. E and product applied per area in Col. F. Indicate the unit of the product in Col. G.												
Col. H, I, J: Prices and Costs	Use 2001 prices and costs. If the product is custom applied you may enter the total cost in the last column (Col. M) and override the formula. If a pesticide is applied by the user, enter the price of the product in Col. H and the cost of applying it in Col. I. Enter any other costs associated with applying this product in Col. J, specifying what they are in the comments section at the bottom of this sheet.												
Col. K: Area Treated	Enter the area receiving at least one application of the pesticide.												
Col. L: # of Applications per Year	Enter the number of applications in a fumigation cycle comparable to methyl bromide for this alternative pest control regimen. Since this number is an average, it does not need to be a whole number.												
Col. M: Cost per Area in 2001 Dollars	Enter the cost per area in 2001 dollars. Col. M will be calculated automatically using the data you have entered for a chemical pest control, or, the formula in Col. M can be overridden if the cost per area is known because the product was custom applied.												
Non-chemical Control	Enter data near the bottom of the form. Identify the control in Col. A. Enter the target pests in Col. B. Describe the non-chemical pest control Col. B-L. Enter the costs in Col. M in 2001 dollars.												
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.													
A	B	C	D	E	F	G	H	I	J	K	L	M	
Name of Product	Target Pests	Active Ingredients (ai) in Product	Formulation of Product	Application Rate			Price per Unit of the Product	Cost of Applying Pesticide per Area	Other Costs per Application	Area Treated at Least Once	# of Applications per Year	Cost per Area (2001\$)	
				lbs. ai per Area per Application	Units of product per Area per Application	Product Unit (e.g., lbs., gals)							
Basamid	weeds/fungi	MITC	67%	350/ac	258	lb	\$ 5.00	\$125/ac			1	\$1875/ac	
												\$ 0.00	
												\$ 0.00	
												\$ 0.00	
												\$ 0.00	
												\$ 0.00	
												\$ 0.00	
												\$ 0.00	
												\$ 0.00	
												\$ 0.00	
												\$ 0.00	
												\$ 0.00	
												\$ 0.00	
												\$ 0.00	
Non-Chemical Pest Control	Target Pests	Description										Cost/area	
												\$1875/ac	
											Total	\$ 0.00	
Comments: If you do not have the quantitative data for additional crops grown on the same land, please indicate so in the comment section.													

Worksheet 3-B. Alternatives - Pest Control Regimen Costs for Alternative:

Metam-sodium

If a consortium is submitting this application, the data for this table should reflect a representative user .												
Col. A: Name of Product and Non-chemical Control	Enter all alternatives and non-chemical pest control that would replace one treatment of methyl bromide throughout the fumigation cycle. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle. If multiple crops are grown If someone other than the applicant previously benefited from the application of methyl bromide in the fumigation cycle and you do not have the quantitative data for the crops grown on the same land, please indicate so in the comments section below.											
Col. B: Target Pests	Be as specific as possible regarding the species or classes of pests controlled by the active ingredient or pesticide product.											
Col. C: Active Ingredients	Use one row for each active ingredient (ai). For example, if a product contains 2 ai's use 2 rows for that product. Once a row is completed for a given product, then only Col. B (if applicable), C, and E need to be completed for additional rows regarding											
Col. D: Formulation	Enter the formulation or the % of active ingredient.											
Col. E, F, G: Application Rate	As a cross check, EPA is requesting both the amount of active ingredient in Col. E and product applied per area in Col. F. Indicate the unit of the product in Col. G.											
Col. H, I, J: Prices and Costs	Use 2001 prices and costs. If the product is custom applied you may enter the total cost in the last column (Col. M) and override the formula. If a pesticide is applied by the user, enter the price of the product in Col. H and the cost of applying it in Col. I. Enter any other costs associated with applying this product in Col. J, specifying what they are in the comments section at the bottom of this sheet.											
Col. K: Area Treated	Enter the area receiving at least one application of the pesticide.											
Col. L: # of Applications per Year	Enter the number of applications in a fumigation cycle comparable to methyl bromide for this alternative pest control regimen. Since this number is an average, it does not need to be a whole number.											
Col. M: Cost per Area in 2001 Dollars	Enter the cost per area in 2001 dollars. Col. M will be calculated automatically using the data you have entered for a chemical pest control, or, the formula in Col. M can be overridden if the cost per area is known because the product was custom applied											
Non-chemical Control	Enter data near the bottom of the form. Identify the control in Col. A. Enter the target pests in Col. B. Describe the non-chemical pest control Col. B-L. Enter the costs in Col. M in 2001 dollars.											
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.												
A	B	C	D	E	F	G	H	I	J	K	L	M
Name of Product	Target Pests	Active Ingredients (ai) in Product	Formulation of Product	Application Rate			Price per Unit of the Product	Cost of Applying Pesticide per Area	Other Costs per Application per area	Area Treated at Least Once	# of Applications per Year	Cost per Area (2001\$)
				lbs. ai per Area per Application	Units of product per Area per Application	Product Unit (e.g., lbs., gals)						
Tarped metam-sodium (vapam sectagon)	weeds/fungi	MITC	42%	464 lbs	109	gallons	\$6.25/gal	\$ 75.00	\$960.00		1	\$ 1,716.25
Non-Chemical Pest Control	Target Pests	Description										Cost/area
											Total	\$ 1,716.25
Comments: Metam sodium needs to be tarped because of the sensitivity of some conifer species to drift and MITC. Pines are especially sensitive. Chloropicrin must also be added because metam will not diffuse readily through												

Basamid and Metam Sodium

The purpose of this worksheet is to identify the gross revenue for units (crop, commodity, structure) when using an alternative compared to gross revenue when using methyl bromide. Post-harvest and structural users may modify this form to accommodate differences in operations when providing gross revenue data.

Col. A: Crop/Commodity	<p>Enter all crops/commodities that can be grown/treated during the same interval of time comprising a methyl bromide fumigation cycle. Please discuss changes in crop cycles resulting from alternative use in the comments. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle.</p> <p>If someone other than the applicant benefits from the application of methyl bromide in the fumigation cycle and you do not have the quantitative data for the crops grown on the same land, please indicate so in the comments section below.</p>
Col. B: Price Factors	Enter in Col. B any factors that determine prices (e.g., grade, time, market). If you received different prices for your crop/commodity as a result of quality, grade, market (e.g., fresh or processing), timing of harvest, etc., you may itemize by using more than one row. Itemize or aggregate these factors to the extent appropriate in making the case that the use of alternatives affects these price factors.
Col. C: Unit of Crop/Commodity	Enter the unit of measurement for your crop/commodity.
Col. D: Crop/Commodity Yield	Enter the number of units of crop/commodity produced per area for that price factor identified.
Col. E: Price	Enter the average 2001 prices received by the users for that crop/commodity and price factor.
Col. F: Gross Revenue	In the electronic version, revenue is automatically calculated below using the data you entered for yield and price. If revenue is not equal to yield times price, you may override the formula and enter a different revenue amount. Please explain why this revenue amount is different in the comment section

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F
Crop/Commodity	Price Factors (grade, time, market)	Unit of Crop/Commodity (e.g., pounds, bushels)	Crop/Commodity Yield (Units per area)	Price (per unit of crop/commodity)	Revenue (per area)
Conifer seedlings	Species/age/size	1000 trees	344	\$ 220.00	\$ 75,680.00
Conifer transplants	Species/size	1000 trees	172	\$ 370.00	\$ 63,640.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
					\$ 0.00
				Total Revenue	\$2.41 million

It is essential to consider indirect effects to accurately assess the impact of the loss of methyl bromide.

Worksheet 3-D. Alternatives - Changes in Other Costs for Alternative:**[Insert name of alternative]**

If a consortium is submitting this application, the data for this table should reflect a <i>representative user</i> .					
Enter data only for costs (other than the cost of alternative pest control) that change as a result of using the alternatives instead of methyl bromide. Enter the whole cost, not just the incremental changes. Enter the cost in Col. B for custom operation costs, or in Col. C and D for operations done by user.					
Col. A: Operation or Cost Item	Identify the operations or cost items that change as a result of not using methyl bromide.				
Col. B: Custom Operation Cost	Enter custom operation costs that change in Col. B.				
Col. C, D, E: Costs per Area	Enter in Col. C and D, material and labor costs per area that change for operations done by user. The total cost per area is calculated automatically from the values you enter in Cols. C and D.				
Col. F: Typical Equipment Used	Identify changes in the typical equipment used by the user as a result of not using methyl bromide. Please be specific such as tractor horsepower. No cost data are required in this column.				
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.					
A	B	C	D	E	F
Operation or Cost Item	Custom Operation Cost per Area	Operation Done by User			Typical Equipment Used
		Material Cost per Area	Labor Cost per Area	Total Cost per Area	
				\$ 0.00	
				\$ 0.00	
				\$ 0.00	
				\$ 0.00	
				\$ 0.00	
				\$ 0.00	
				\$ 0.00	
				\$ 0.00	
				\$ 0.00	
				\$ 0.00	
				\$ 0.00	
				\$ 0.00	
				\$ 0.00	
				\$ 0.00	
				\$ 0.00	
Total Custom per Area	\$ 0.00		User Total per area	\$ 0.00	

Comments:

Alternatives: Changes in Other Costs for Alternative

There are significant indirect costs associated with the loss of methyl bromide fumigation in forest tree nurseries. Although most nurseries in the West only use methyl bromide in areas where the alternatives are unsuitable (i.e. increased risk of crop damage, lack of suitable weed control, etc.), there is not currently a viable substitute for methyl bromide fumigation in these situations. The "market disruption" to the forest tree nursery business will not occur from the increase in the cost of soil fumigation, but as a result of a decrease in planting stock quality and an increase in planting stock price. The most serious consequences will not be the direct effect of using a more expensive or less effective fumigation alternative, but rather the long-term effect on the reforestation program in the Western United States.

The loss of methyl bromide in areas where alternatives are unsuitable will cause a decrease in seedling numbers per unit of area, a decrease in average seedling size, and an increase in weed control costs.

The cost of a reduction in seedling production per unit of area.

The bed density of bareroot conifer seedlings is, on average, 344,250 per acre. For conifer transplants, the bed density is, on average 172,125 per acre. At \$220/1000 seedlings and \$370/1000 transplants, this is a value of \$68,850 and \$60,246 respectively per bed acre. By increasing the number of saleable seedlings or transplants by only 1 per square foot of bed space, the value of the bed acre increases by \$9580 for seedlings and \$16100 for transplants. This is substantially more than the cost of fumigation.

The cost of a decrease in average seedling size

It has been established that larger seedling sizes translate into increase survival and growth during reforestation. Research around the country has shown that fumigation can significantly increase the production of higher grade seedlings in the nursery. When the effect of fumigation is multiplied over the number of seedlings produced and the number of acres planted annually in the Western United States, the indirect effect of nursery fumigation becomes quite significant.

The cost of increased weed competition

Methyl bromide fumigation provides cost effective control of many noxious weed species, including nutsedge (*Cyperus* spp.) and its loss will result in an increase in herbicide use and/or an increase in handweeding. Although cost effective herbicides are available for forest tree nurseries, they are not effective against all weeds. The increase in weeding costs will be sufficient to result in higher seedling prices for conifer species.

Summary

The loss of methyl bromide fumigation in forest tree nurseries will have significant large scale disruptions that go well beyond the nursery. While direct effects on seedling production, seedling quality, and seedling cost may in fact be documented, the true market disruption is the indirect effect on plantation establishment and growth over the all the reforested acres each year.

Worksheet 4. Alternatives - Future Research Plans

Please describe future plans to test alternatives to methyl bromide. (All available methyl bromide alternatives from the alternatives list should have been tested or have future tests planned.) There is no need to complete a separate worksheet for future research plans for each alternative - you may use this worksheet to describe all future research plans.

1. Name of study: Various studies

2. Researcher(s): USDA Forest Service and State nursery cooperators

3. Your test is planned for: 2002 and continuing

4. Location: Various nurseries throughout the region

5. Name of alternative to be tested:

Continue to test basamid, metam sodium, and organic amendments/cover crops/sowing alternatives

6. Will crop yield be measured in the study? Yes X No

7. If additional testing is not planned, please explain why. (For example, the available alternatives have been tested and found unsuitable, an alternative has been identified but is not yet registered for this crop, available alternatives are too expensive for this crop, etc.)

Worksheet 5. Additional Information

1. How will you minimize your use and/or emissions of methyl bromide?

1a. Check all methods you will use ☐ Nothing
☒ Tarpaulin (high density polyethylene)
☒ Virtually impermeable film (VIF)
☒ Cultural practices (please specify) Timing of sowing, depth of sowing

1b. Will you use other pesticides to reduce use of methyl bromide? Yes ☒ No ☐

If yes please specify. Basamid, oxyflorfen, chlorothalonil, dursban, and a variety of herbicides/fungicides

1c. Other non-chemical methods: (please specify):

Fallow, organic amendments, various seedbed coverings

2. Do you have access to recycled methyl bromide? Yes ☐ No ☒

If yes, how many pounds? _____ lbs.

3. Do you anticipate that you will have any methyl bromide in storage on January 1, 2005? Yes ☐ No ☒

If yes, how many pounds? _____ lbs.

4. What is the cumulative amount spent to date by the user or consortium on research to develop alternatives to methyl bromide (beginning in 1992)? \$ no cum. data

5. Other investments, if any, made to reduce your reliance on methyl bromide. Describe each investment and its associated cost.

Pursuit of suitable weed control methods

6. Identify what factors would allow you to stop or reduce your use of methyl bromide (e.g. registration of particular pesticide; completion of research plan; capital outlay).

Effectiveness of alternatives

When do you expect these to occur? _____

7. Range of acres farmed by growers included in this application?
(insert number of users in each category)

1 0-10 acres
1 10-25 acres
2 25-50 acres
_____ 50-100 acres
3 100-200 acres
3 200-400 acres
_____ over 400 acres

Worksheet 5. Additional Information (continued)

8. Range of square feet of the area to which applicants included in this application will apply methyl bromide? (insert number of users in each category)

____ 0 - 5,000 sq. ft.
____ 5,001 - 10,000 sq. ft.
____ 10,001 - 20,000 sq. ft.
____ 20,001 - 40,000 sq. ft.
1 40,001 - 80,000 sq. ft.
1 80,001 - 160,000 sq. ft.
8 over 160,000 sq. ft.

I certify that all information contained in this document is factual to the best of my knowledge.

Signature /s/ Lee E. Riley

Date 9/6/2002

Print Name Lee E. Riley

Title Project Leader

Information in this application may be aggregated with information from other applications and used by the United States government to justify claims in the national nomination package that a particular use of methyl bromide be considered "critical" and authorized for an exemption beyond the 2005 phaseout. Use of aggregate data will be crucial to making compelling arguments in favor of critical use exemptions. **By signing below**, you agree not to assert any claim of confidentiality that would affect the disclosure by EPA of aggregate information based in part on information contained in this application.

Signature /s/ Lee E. Riley

Date 9/6/2002

Print Name Lee E. Riley

Title Project Leader

Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information. Public reporting burden for this collection of information is estimated to average 324 hours per response and assumes a large portion of applications will be submitted by consortia on behalf of many individual users of methyl bromide. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a current OMB control number.

Worksheet 6. Application Summary

This worksheet will be posted on the web to notify the public of requests for critical use exemptions beyond the 2005 phase out for methyl bromide. Therefore, this worksheet cannot be claimed as CBI.

1. Name of Applicant: Western Forest and Conservation Public Nursery Association

2. Location:

3. Crop: Forest Tree Seedlings

4. Pounds of Methyl Bromide Requested	2005	45000
---------------------------------------	------	-------

5. Area Treated with Methyl Bromide	2005	150	acres units
--	-------------	-----	-------------

6. If methyl bromide is requested for additional years, reason for request:

2006	45000 lbs.	Area Treated	150	acres	units
-------------	-------------------	---------------------	------------	--------------	--------------

2007	45000 lbs.	Area Treated	150	acres	units
-------------	-------------------	---------------------	------------	--------------	--------------

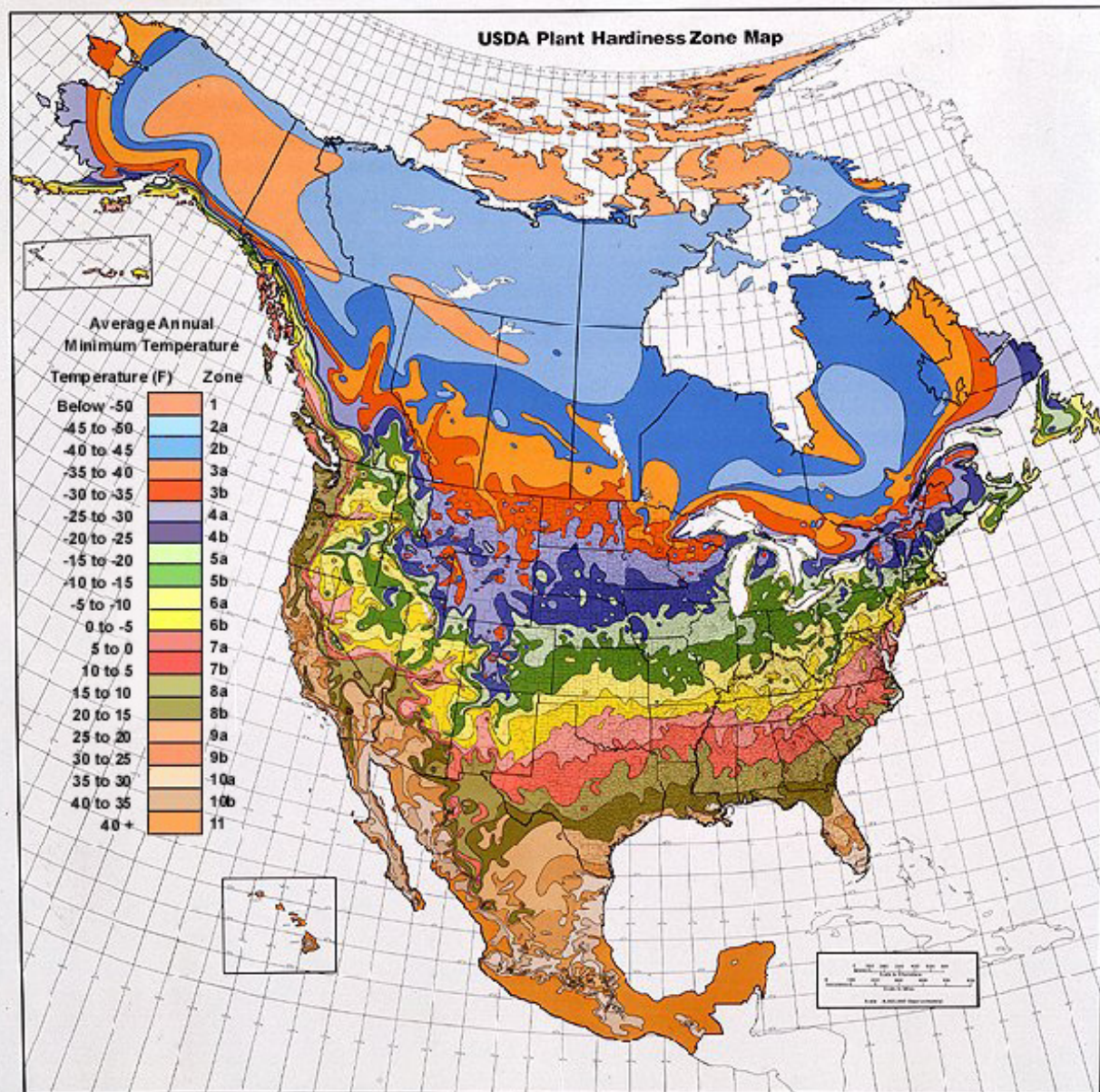
Place an "X" in the column(s) labeled "Not Technically Feasible" and/or "Not Economically Feasible" where appropriate. Use the "Reasons" column to describe why the potential alternative is not feasible.

[illegible]

Fumigation Cycle Definitions:

Fumigation cycle:	The period of time between methyl bromide fumigations.
Year:	If a fumigation cycle overlaps more than one calendar year, "year" refers to the calendar year when methyl bromide is applied (or the beginning of the cycle).
Comparable data:	In order to compare revenues and costs with and without methyl bromide, data on alternatives for pest control, yields, revenues, and costs must be for the same time interval as the methyl bromide fumigation cycle. If, however, quantitative data, is not available for the entire fumigation cycle, then to be comparable, the quantitative data for the alternatives should cover the same portion of the fumigation cycle as the quantitative data for methyl bromide, and the rest of the cycle should be discussed in the comments sections.
2-year example:	If a methyl bromide fumigation is made every 2 years, then the 2001 fumigation cycle began in 2001 and would end in 2003. The data should cover the methyl bromide costs and usage for the methyl bromide fumigation made in 2001, and all yields and revenues received and other costs incurred during the 2 year period. To be comparable, the data on alternatives should cover a similar 2 year period beginning in 2005 beginning at the same time of year when a methyl bromide fumigation would be made. The data should cover all methyl bromide alternatives used, and all yields and revenues received during that 2-year interval. Other pest control and other costs would only need to be provided for that interval if they would change from what they were with methyl bromide.
Other beneficiary example	If someone other than the applicant benefits from a methyl bromide fumigation, you should comment on these benefits if you do not have quantitative data for the entire fumigation cycle. For example, if a rotational crop in the second year benefits from a methyl bromide fumigation a year earlier, but there is quantitative data only on the first crop, then the data on the alternatives should cover only the first crop, and the benefits of methyl bromide and the additional pesticides that would have to be used on the rotational crop should be discussed in the comments sections.
Crop cycle change example:	If in a one year interval, methyl bromide is applied, tomatoes are grown and harvested followed by peppers, then the fumigation cycle would be one year including the tomatoes and peppers. If, however, without methyl bromide, it is not possible to follow tomatoes with peppers in the same one year interval, then the alternative data on pesticides, costs, yields, and revenues should just cover tomatoes. The loss of profit from not being able to grow peppers with the alternatives would be part of the loss from not having methyl bromide.

USDA Plant Hardiness Zone Map



Appendix 1

Information for Worksheet 3-A.

Several studies have been completed in the western states in addition to those found in the format of worksheet 3-A and 3-B. These additional studies do not lend themselves to the format as presented. In addition, several of the studies detailed in the worksheets have been published in various Nursery Proceedings or Internal Memos during the early stages of data collection.

Table 1. Summary of alternatives to fumigation studies.

Year	Location (s)	Treatments	Report as numbered below
1990	One nursery in OR	Fallow, cover crop, MBC	5
1990	Three nurseries in WA, OR	Cover crops and MC33	1
1993-95	Six nurseries in CA, ID, OR	Organic amendments and Basamid	2 + worksheets 3A and 3B
1995-98	Six nurseries in CA, ID, OR	Organic amendments and Basamid	worksheets 3A and 3B
1999	One nursery in ID	Basamid	4
2001	One nursery in ID	Fallow, soil amendments, MBC	3

- 1) Hansen EM, Myrold DD, Hamm PB. 1990. Effects of soil fumigation and cover crops on potential pathogens, microbial activity, nitrogen availability, and seedling quality in conifer nurseries. *Phytopathology* 80(8): 698-704.
- 2) Hildebrand DM, Stone JK, James RL, Frankel SJ, Pokorny JD, O'Brien JG, Cram MM. 1995. Alternatives to chemical fumigation technology development project: Preliminary results. In: Landis TD, Cregg B, technical coordinators. *National Proceedings: Forest and Conservation Nursery Associations - 1995*. Portland (OR): USDA Forest Service, Pacific Northwest Research Station. General Technical Report PNW-GTR-365: p 15-22.
- 3) James RL. 2001. Effects of pre-sowing soil treatments on root colonization of 1-0 ponderosa and lodgepole pine seedlings by potentially-pathogenic fungi, USDA Forest Service Lucky Peak Nursery, Boise, Idaho. *Plant Health Protection Report* 01-9. Missoula (MT): USDA Forest Service, Northern Region. 9 p.
- 4) James RL, Beall, K. 1999. An evaluation of the effects of dazomet on soil-borne diseases and conifer seedling production – USDA Forest Service Lucky Peak Nursery, Boise, Idaho. *Plant Health Protection Report* 99-9. Missoula (MT): USDA Forest Service, Northern Region. 15 p.
- 5) Stone JK, Hansen EM. 1993. Green manure effects on soilborne pathogens. In: Landis TD, technical coordinator. *Proceedings: Northeastern and Intermountain Forest and Conservation Nursery Associations*. Fort Collins (CO): USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-243: p 57-64.

Summary of research into alternatives to methyl bromide.

Methyl bromide, in general, seems to work well across the geographic region covered by this consortium. The various alternatives, including fallow, tilling, organic amendments, cover crops, Basamid, and metam sodium, varied widely in efficacy among nurseries. Basamid appears to produce the best results, with similar yields to those crops grown following methyl bromide fumigation. However, weed control was significantly less with Basamid than methyl bromide, increasing the rates of herbicide use and/or hand weeding.

Use of fallowing, tilling, organic amendments, and cover crops appeared to show mixed results. Each treatment depended on the nursery environment, nursery soils, crop type, etc. and would only be applicable in small areas. Use of any of these treatments on a production basis would require further research and large risk to crop production.